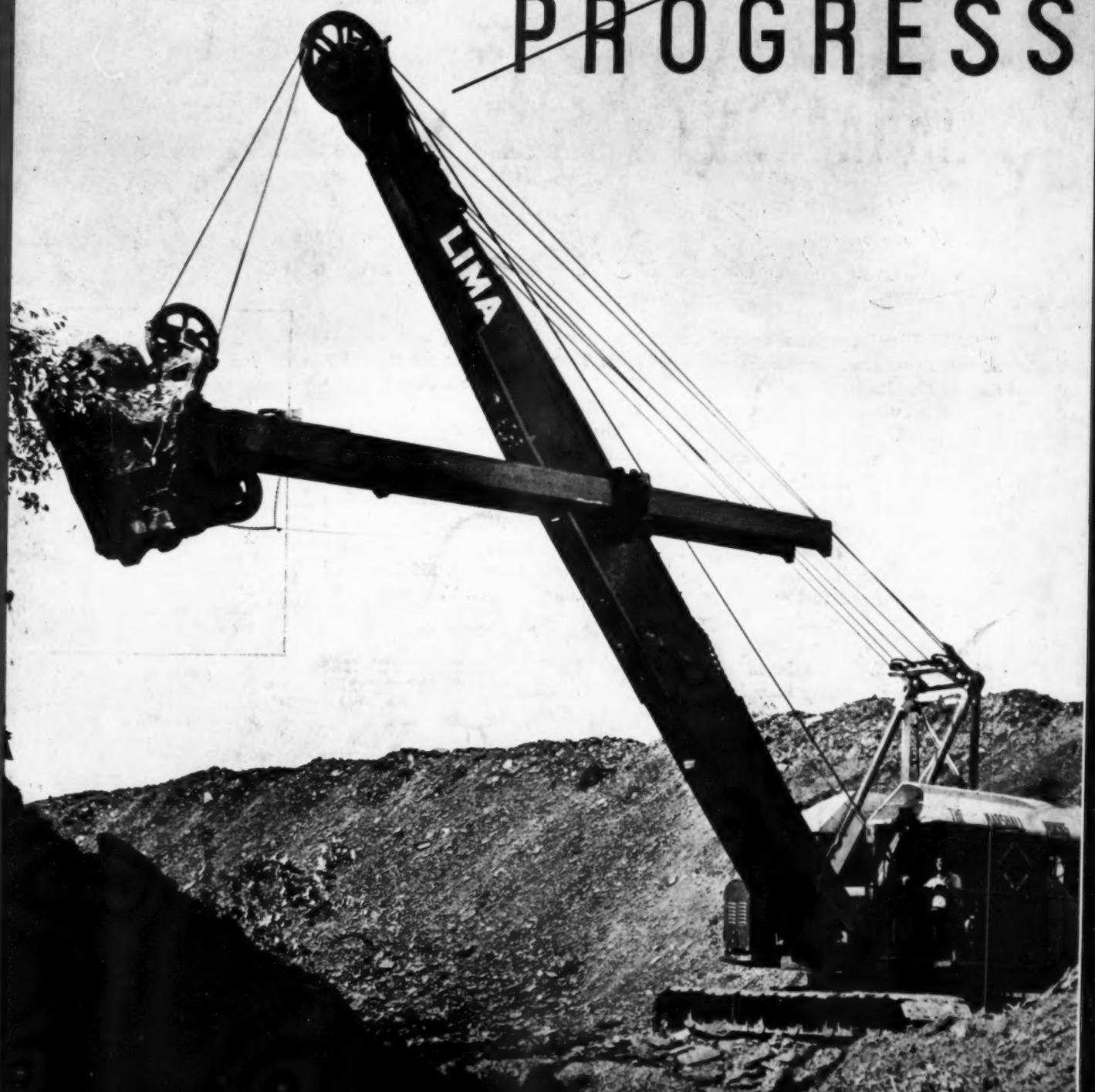
APRIL, 1942

DIESEL PROGRESS

IN INDUSTRY • IN TRANSPORTATION • ON THE SEA • IN THE AIR



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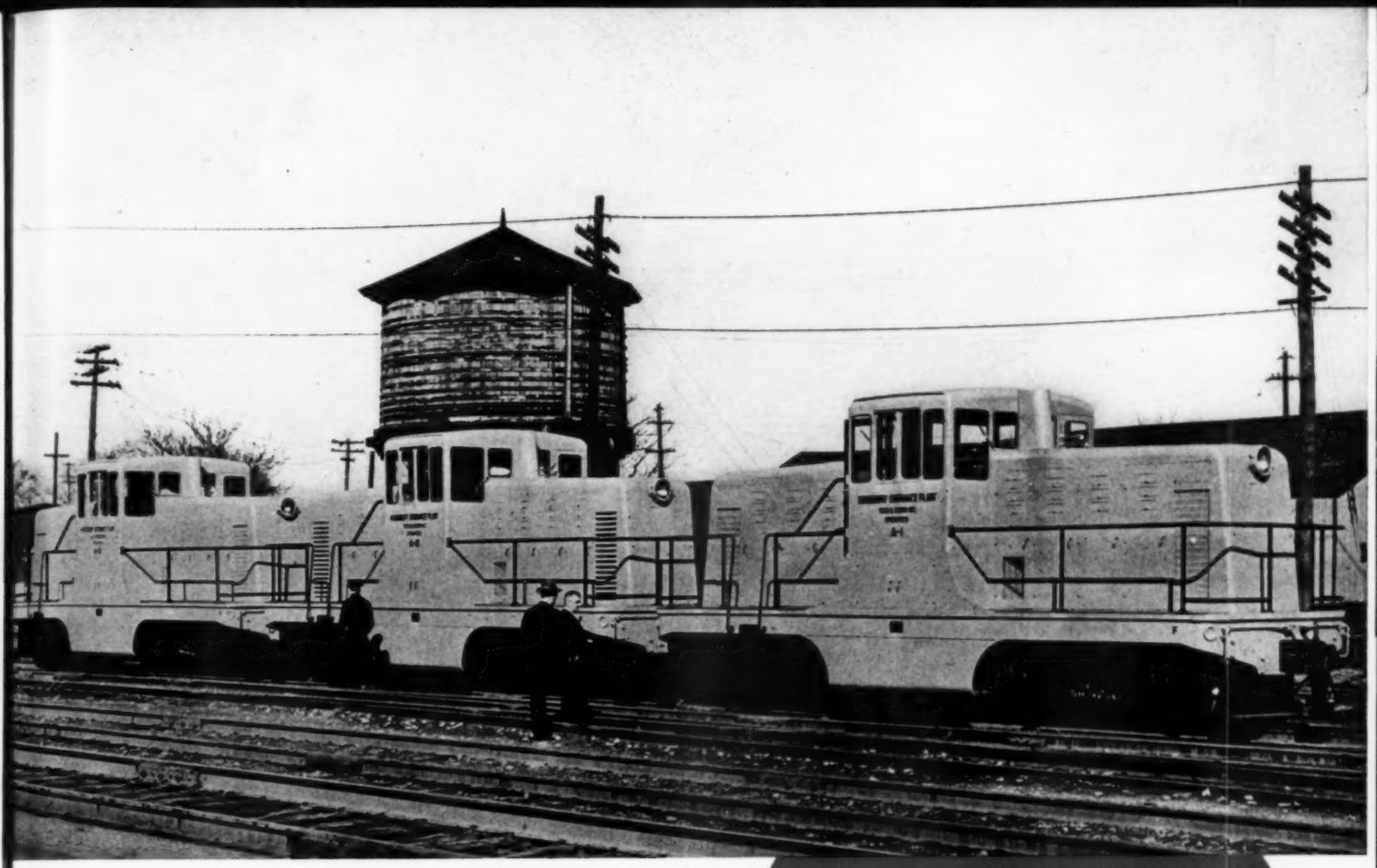
DIESEL PROGRESS for April, 1942. Volume VIII, Number 4. DIESEL PROGRESS is published monthly by Diesel Engines, Inc., 2 West Forty-fifth Street, New York, N. Y. Rex W. Wadman, President. Acceptance under the Act of June 5, 1934, at East Stroudsburg, Pa., authorized March 27, 1940. Subscription rates: $5.00 per year, single copy, 50c.



DIESEL and GAS ENGINE PROGRESS

REX W. WADMAN
Editor and Publisher

FRONT PAGE ILLUSTRATION: A [illegible] yard shovel powered with a [illegible]ains, 6 cylinder, 230 hp. Diesel [illegible] through a Twin Disc clutch. E. [illegible] Burns, operator, says: "Good engine; [illegible] still—I've been operating shovels [illegible] and haven't seen anything that [illegible] this one."

TABLE OF CONTENTS ILLUSTRATION: Three of ten 85-ton, 400 hp. [illegible] electric switching locomotives in [illegible] an Ordnance Plant. Built at [illegible], Pa., Works of General Electric. [illegible] locomotives are powered with [illegible] Diesels and G. E. generators [illegible] motors.

DIESEL PROGRESS for April, 1942, Vol. [illegible] No. 4. Published monthly by Diesel [illegible], Inc., 2 West 45th St., New [illegible], N. Y. Tel. MUrray Hill, 2-7333. [illegible] rates: $5.00 per year, 50c [illegible] copy.

HEYWORTH CAMPBELL
Art Director

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Neodesha, Kansas, Runs One Diesel 52,181 Hours

By WM. H. GOTTLIEB

DIESELS in the municipal plant at Neodesha, Kansas, are setting a record for continuous trouble-free service. When this plant was visited in September, 1941, the largest engine, an 880 hp. Nordberg Diesel, was rounding out its seventh year and during this period it had run a total of 52,181 hours out of a possible 61,320, more than 85 percent of the time. In the year 1939, the engine operated 8,624 hours out of a possible 8,760, actually more than 98.4 percent of the time. In the year 1940, the same unit operated 8,607.5 hours or 97.99 percent of the time. This is a remarkable record for an engine of this size.

Continuous operation is not just a whim of Neodesha engineers. For twenty years, the city has placed full dependence for light, power and water in the performance of Nordberg Diesels. Two 550 hp. units were installed in 1922, replacing the former steam plant; the 880 hp. engine was put into operation in August, 1934. The city load has grown to the point where operation of the large Diesel is essential to carry the peaks. Even during the late night hours when demands are lowest, it is necessary to have reserve engine capacity constantly available because the plant serves the world's largest alfalfa mill twenty-four hours a day and a couple of hundred kilowatts may be dumped on the line at any time.

It is evident that engine dependability is a matter of crucial importance to Neodesha. If the big engine went down, the plant could not take the peaks and either the lighting service would be discontinued or the city's principal industry would shut down. The city's confidence has not been misplaced. In 1940, the last full year of operation, there were no interruptions of service whatever. During the years the big engine has been in service, interruptions have totalled just 25 minutes. In the sixteen years that such records have been kept, service interruptions totalled 2 hours and 35 minutes and most of that time was used in 1934 to hook in the third engine.

Diesel operation at Neodesha has been economical as well as dependable. Though the swinging load of the alfalfa mill is not conducive to engine efficiency, the plant has managed to cut its costs from year to year. In 1940, the total operating cost per kilowatt-hour, including fuel, lubricating oil, labor, repairs and supplies, was 6.33 mills.

All three engines are air-injection, cross-head type, two-cycle Nordberg Diesels. The older units each have five cylinders of 15 in. bore and 20 in. stroke and develop 550 hp. at 225 rpm. Each drives directly at 375 kw. General Electric alternator with chain driven exciter. The third engine has four cylinders, 17 in. x 24 in., and develops its rating of 880 hp. at 257 rpm. This engine drives directly a 600 kw. 2300 volt, General Electric alternator with direct-connected exciter.

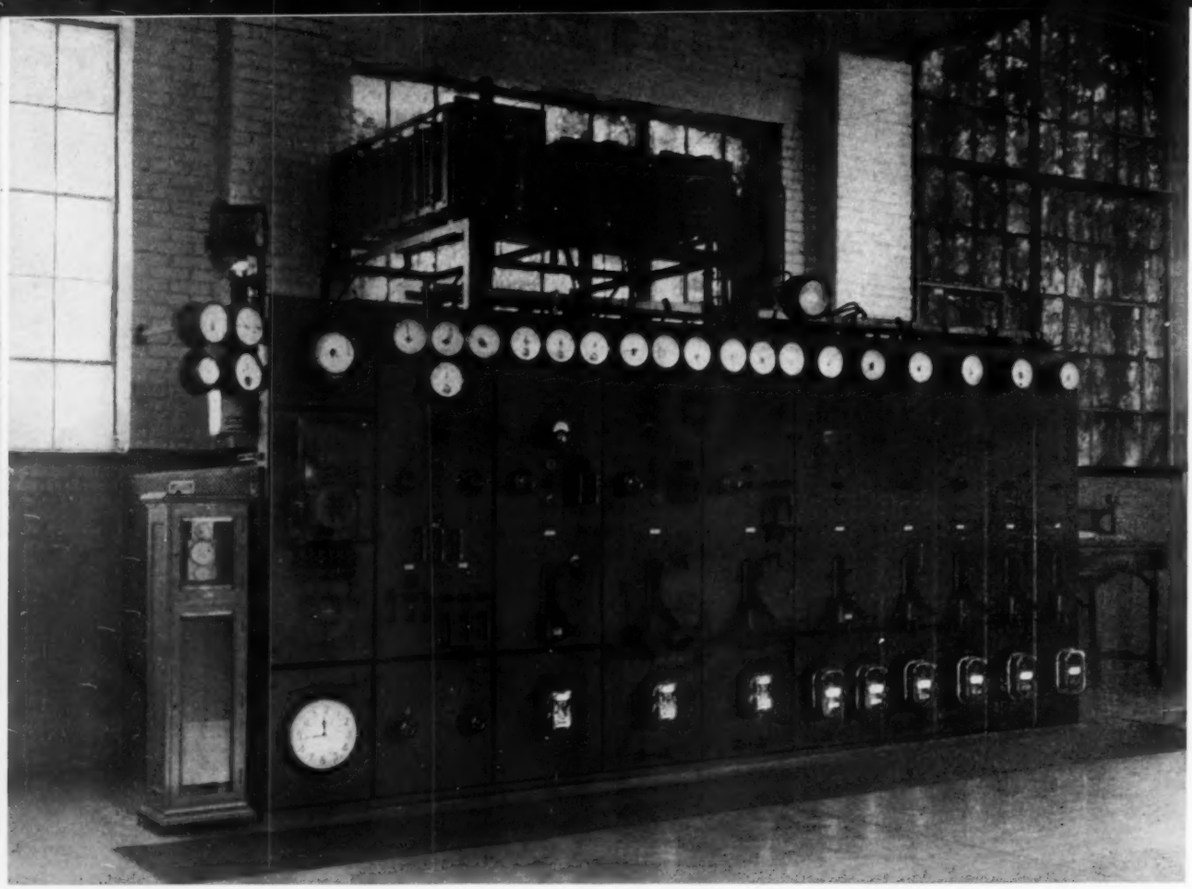
The plant adjoins a Standard Oil Company refinery and the 24 gravity fuel oil is pumped through a short pipe line to a 10,000 gallon storage tank above ground. Fuel flows by gravity from storage to the suction of a motor-driven gear pump which services a 563 gallon tank high on the wall inside the engine room. From this point, fuel flows to a day tank for each of the older units and then by gravity to the engine pumps. In the case of the newer unit, fuel goes by gravity from the tank on the wall to a day tank in the basement where it is picked up by the built-in engine pump.

To permit long, continuous operation, lubricating oil must be kept in good condition. The 880 hp. engine has a pressure circulating system. A crankshaft-driven pump takes oil from the engine sump, puts it through a filter and cooler, then sends it to the bearings and oil cooled pistons and returns it finally to the

The twenty-year-old Diesel Municipal Power Plant at Neodesha, Kansas. Sign on the stack reads, "This Plant Is Not For Sale."

Two Nordberg Diesels installed in 1922.

This Nordberg Diesel and G. E. Generator, installed in 1934 have operated 98.4% of the total elapsed time. Note Manzel lubricator.



The Westinghouse switchboard and General Electriv voltage regulator. Note Alnor pyrometer.

sump. A portion of the oil is bypassed through a centrifuge which operates continuously. In addition, the plant contains an activated clay reclaimer which can be used either for continuous bypass or batch purification. As a final precaution, the system of each engine is drained once a year. Cylinders of the 880 hp. engine are supplied by mechanical lubricators. The 550 hp. engines employ a gravity feed system. Oil from the crankcase drains to a tank in the basement, entering at the bottom of the tank and coming up through water and a cloth strainer. It is picked off the top by gear pumps driven off the camshaft and sent up to elevated supply tanks from which it flows by gravity to the bearings. Here, too, there are mechanical lubricators for the cylinders.

Soft city water is put through the engine cooling systems under city pressure reduced from 60 to 30 pounds. Leaving the plant, the water flows to an underground reservoir, then to a settling basin, and finally reenters the city filtration plant. A motor-driven centrifugal pump serves as a standby for the cooling system. All three Diesels are provided with air filters of the impingement type. Intake air for the big unit passes through an eight-element filter in a brick housing outside the plant. The two six-element filters for the smaller engines are set in the outside wall of the plant considerably above the level of the engines.

The bottles for storage of starting air are usually filled by one or another of the engine compressors. For standby there is a two-stage compressor belted to a gasoline engine through a friction clutch. Each engine has its own gauge board and the newest unit has a multipoint exhaust pyrometer. The ten panel switchboard has a full complement of instruments including a recording voltmeter and totalizing kilowatt-hour meters. In this plant of swinging loads, a voltage regulator is essential equipment.

This municipal plant is returning substantial cash dividends to the city treasury in addition to more than 80,000 kilowatt hours of free service a year. Consumer rates have been cut sharply and the supply of cheap power is an important factor in keeping a major industry in the city. Neodesha engineers would like to see a fourth engine to assure adequate reserve capacity, but so long as the need for continuous, flawless performance exists, they are confident on the basis of experience that their plant can deliver the goods.

The Diesels are Nordbergs, the generators G.E. The Standard Oil of Indiana fuel is handled by a Viking transfer pump and the same company supplies the lubricating oil, R.P.M. Delo for cylinders, and Nonpareil Heavy in the crankcase and Nonpareil "w" for the compressors. The mechanical lubricators are Manzel, the lube coolers and filters Schutte & Koerting, the lube purifier Youngstown Miller and the centrifuge De Laval. The cooling water pump is a Goulds, aid filters Reed, exhaust pyrometer Alnor, air compressor Nordberg, the switchboard Westinghouse, the voltage regulator G.E.

Neodesha, Kansas, Municipal Plant
Six Year Record

Year	Kw. Hrs. Gen.	Engine Repairs	Engine Hours	Total Operat. Cost	Revenue-Light & Water	Operating Cost Per Kw. Hr.
1935	2,346,300	$ 97.15	11,885	$17,910.50	$54,243.91	.00763
1936	2,744,000	166.65	11,554.5	$18,461.85	$58,085.41	.00673
1937	2,998,600	200.44	12,108	$20,244.70	$64,254.18	.00675
1938	3,079,100	598.16	11,511.5	$19,972.42	$66,371.70	.00649
1939	3,269,200	3501.82	12,537.5	$23,625.46	$69,616.26	.00723
1940	3,700,900	437.39	14,819.5	$22,827.90	$76,576.05	.00617

NAVY "E" AWARDS

New York Herald Tribune Photo.

U. S. Navy Confers High Honors For Excellence On

Consolidated Shipbuilding Corporation

Dravo Corporation

Wheeler Shipbuilding Corporation

Gibbs Gas Engine Company

THE Navy "E" is a symbol of efficiency, excellence, and achievement. It is the Navy's way of saying "WELL DONE!" Between 1906, when this custom was instituted, and the present emergency the conferring of the "E" for "Excellence" outside of the Navy personnel was restricted to Navy Ordnance contractors. Recently, by special permission of President Roosevelt and Secretary of the Navy, Frank Knox, the Bureau of Ships has been permitted to ward the Navy "E" to certain industries whose work for the Navy merited this honor. The four shipyards mentioned here, all buiding ships using Diesel engines exclusively, were among the first to be so honored by the United States Navy. Hearty congratulations to them and to all proud possessors of the Navy "E".

Consolidated Shipbuilding Corporation

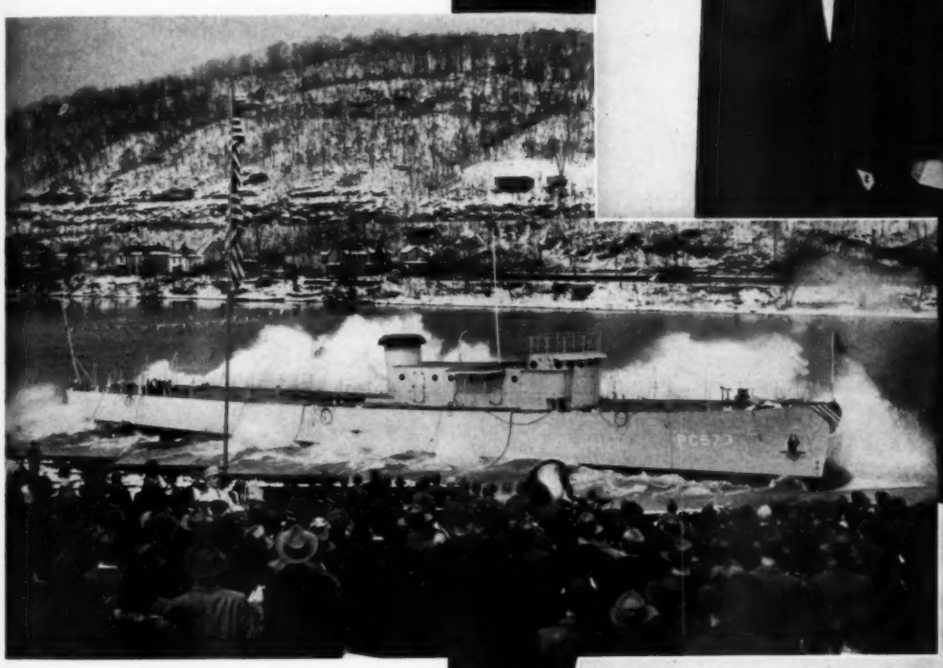
Sponsor of the USS PC 487, Mrs. John D. Bulkely whose husband was in command of the PT boat credited with sinking a 5,000 ton Japanese transport in Subic Bay in the Philippines.—Morris Rosenfeld Photos.

At the presentation of the Navy "E" award to Consolidated Shipbuilding Corporation. From left to right: William G. Wood, President, and William F. Bleakley of Consolidated; Rear Admiral William C. Watts, U.S.N. Retired; Captain J. M. Irish, Supervisor of Shipbuilding.

Mrs. John D. Bulkely christening the PC 487 just before the presentation of the Navy "E" award to Consolidated Shipbuilding Corp.

THE Consolidated Shipbuilding Corporation was organized in 1885 and for over fifty-four years has been located at Morris Heights, New York City. The company has a long and distinguished record of service to its Government and the Navy. The first contract entered into with the Bureau of Ships was for the development of a new type destroyer in 1897. In 1917, Consolidated again returned to the production of Naval vessels completing for the Navy Department a number of one thousand ton minesweepers. The beginning of the limited emergency program for defense found the corporation producing for the Bureau of Ships four seagoing tugs of the YT class. In the pre-delivery period of these vessels the Bureau of Ships again selected Consolidated to produce boats of the PC type.

Dravo Corporation



The ceremonies incidental to the presentation of the All-Navy "E" were climaxed by the launching of PC 573, fifth submarine chaser of its type to be launched at the Dravo yards since last fall.—Purdy, Pix and Bulletin Index Photo.

THE Dravo Corporation of Pittsburgh became the first defense industry in the nation to receive the All-Navy "E" on March 5 in a ceremony high-lighted by the launching of a submarine chaser, the PC 573. High ranking officers of the Navy, Government officials, and many of the leading businessmen of Pittsburgh took part in the program that was broadcast by Lowell Thomas, radio commentator. Nearly 5,000 persons, including Dravo employees, attended. The coveted All-Navy "E" was awarded to Dravo after the firm had been recommended by two bureaus of the Navy Department for Excellence—a very rare recommendation that carried with it the right of employees to wear the Navy "E" lapel buttons and the right of the firm to fly the All-Navy "E" pennant for six months.

A YEAR ago the Wheeler Shipbuilding yard at Whitestone, N. Y., was a blueprint. Today it is a booming yard turning out minesweepers in assembly-line fashion. Grading for the plant started last April. The keel for the first craft was laid June 6 and that ship, the YMS 42, was launched March 17. On March 11, the company was honored by presentation of the coveted Navy "E" award by Rear Admiral William C. Watts, U. S. N. Retired, to E. Lawrence Wheeler, President. Capt. J. M. Irish, Bureau of Ships, Navy Department, awarded the lapel buttons to Wheeler employees.

← *At the Navy "E" presentation ceremonies, Mayor LaGuardia of New York addresses the Wheeler officials and employees and Naval officials. Seen in this view are the Bureau of Ships' flag and Navy "E" pennant awarded to Wheeler Shipbuilding Corp. for speed and excellence in building minesweepers. — New York Herald Tribune Photo.*

Minesweeper YMS 62 hits the water with a spectacular splash at Jacksonville, Fla.

Gibbs Gas Engine Company

↓ *From left to right: Mayor of Jacksonville, Rear Admiral Wat Tyler Cluverius, J. Roy Duggan, representing the Gibbs Gas Engine Co., and Secretary of the State, R. A. Gray, presenting the Navy "E" pennant.*

GIBBS Gas Engine Company of Jacksonville, Florida, builder of ships and engines was the proud recipient of the Navy "E" award on February 25. Representing the Secretary of the Navy was Rear Admiral Wat Tyler Cluverius making the presentation. Immediately following the Navy "E" ceremonies, the Gibbs yard launched its ninth minesweeper, the YMS 62, with Mrs. Spessard L. Holland, wife of the Governor of Florida, as sponsor.

DIESEL TRUCKS GO TO SEA

IN the service of "The Motor Freight Line that Goes to Sea," slogan of the Overseas Transportation Company of Miami and Key West, Florida, three heavy-duty Dodge-Diesel trucks roll on a seven-day schedule, hauling everything from a 1,000-pound cake of ice to the U. S. Mail between the mainland and the island city of Key West, headquarters of the company, and to the small fishing camps and communities that dot the Florida Keys. These trucks literally do "go to sea." Seven-Mile Bridge, a marvel of engineering skill, takes the trucks almost out of the sight of land. Bahia Hondia span, which has a grade of about 22 per cent, takes the trucks steadily upward over the old Florida East Coast railroad bridge, reaching a dizzy height of 75 feet over the rolling waters of the Atlantic Ocean. All through the toll bridge district, a distance of about 54 miles, the highway is laid on the old railroad bed and on top of the railroad bridges. Averaging 12-3/10ths miles to the gallon of fuel, the three Dodge-Diesel trucks have rolled a total of more than 50,000 miles since being put in this service in April and June, 1941. And it's the general feeling down there along the sun baked keys that these powerful Diesels, a familiar sight with the stainless steel trailers and red painted cabs, are due for a long, strenuous life of heavy hauling and hard pounding.

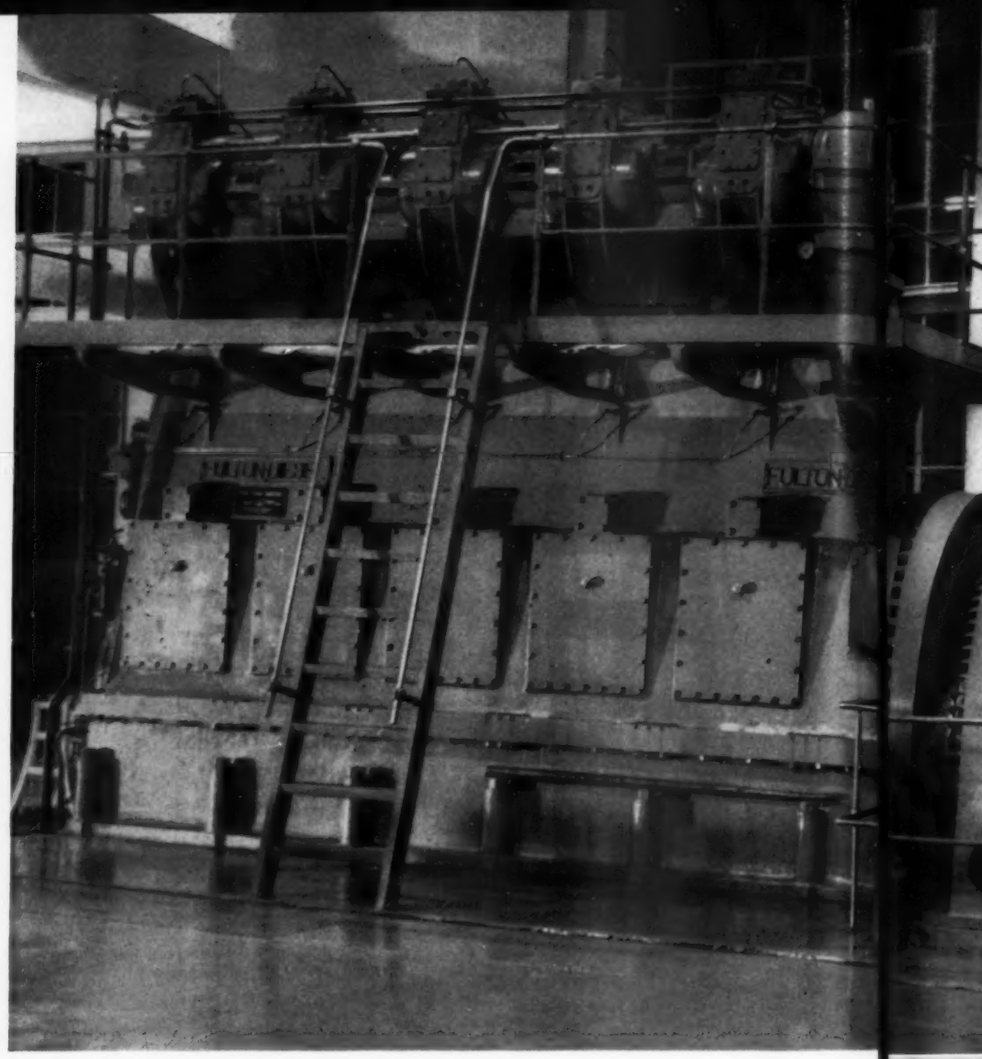
In addition to the steep Bahia Hondia grade, which the trucks, under normal conditions and in overdrive, negotiate at a speed of 25 miles per hour from the beginning of the incline until they are over the top, there are some parts of the 344-mile round trip that are over the roughest kind of macadam.

C. R. Roberson, left, of Overseas Transportation Co. points out to H. S. Jaeger, manager of the company's Miami office, some of the fine points of their Dodge Diesel.

One of the "Seagoing" Diesel trucks crossing Seven-Mile Bridge on the Overseas highway between Miami and Key West, Florida.

HALF CENTURY OF PROFITS

By G. V. YARGER*



FIFTY-TWO years of municipal ownership and operation of the electric and water utilities in the town of Greenfield, Iowa, has made its 1,900 citizens enthusiastically aware of the many benefits derived from such operations. Like most community power plants, pioneered as far back as 1890, Greenfield launched its municipal utility venture with a steam unit and direct current generator originally intended for street lighting only. Today, this interesting electric plant rates as one of the oldest in the State, has long since been fully Dieselized, and its fine record of free service to the community, payment for expansion and new equipment, and enviable cash balance all attest to good management and above all the soundness of municipal ownership.

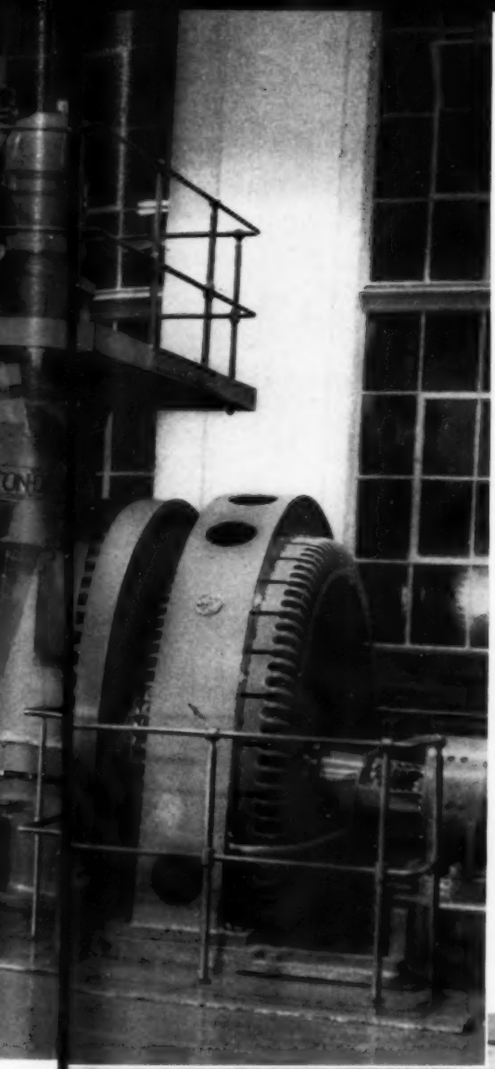
By 1924, the original plant and steam unit had outlived their usefulness and in that year a new plant building was put up with provision for the first Diesel generating unit and with what proved to be a wise eye to future expansion, for since then three Diesel units have been added, making the total capacity 1475 kw.

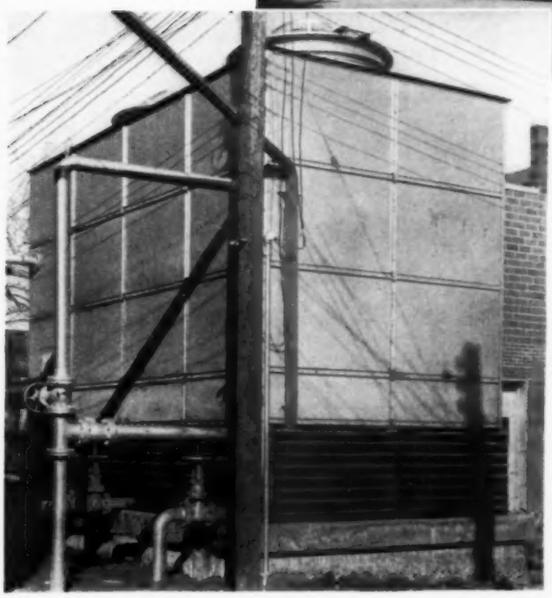
The first step "Dieselwise" was the installation of a 3 cylinder, 16½" by 24", 300 hp. Fulton Diesel, direct connected to a 200 kw. General Electric alternator. Modernization and expansion of the Greenfield plant continued with the installation, in 1925, of another Diesel generating unit, consisting of a Fulton, 400 hp. engine and a 275 kw. G.E. generator. Between 1925 and 1939, the plant continued to handle the demand with its installed equipment and to show excellent returns in the form of free service to the town, resulting in lower taxes, also amortization of debt, and appreciable cash balances from net profits.

At the close of this period, a new expansion program was started to meet the steadily increasing demand. The Stanley Engineering Company was called in as consultant and, in 1940, plans were completed for another generating unit. Performance of the first two Diesels and generators over a period of fourteen years had been entirely satisfactory in view of which machines of the same make were again specified —this time a 5 cylinder, 17½" by 24½", 730 hp. engine and 500 kw. alternator. With this unit, a new Marley induced draft cooling tower and a Re-Nu oil lube purifier were installed with necessary pumps and tanks. This phase of the Greenfield plant growth culminated with the installation in 1942 of a fourth Diesel generating unit—a duplicate of the equipment added in 1940. This last expansion was necessitated by the assumption of an R.E.A. load and normal extension of service to customers. Greenfield's Municipal Electric plant renders free services including street lighting and water pumping equaling better than $6,000 per year. Its consistent, even rapid growth in the last few years, may definitely be considered a function of Diesel economy and low maintenance cost best illustrated by figures for the years 1936-1940 inclusive which show an increase in output from 1½ million kwh. to 2¼ million kwh. and a total net profit of $58,755.19 for these five years' operation.

Essential operating accessories for the Diesels include intake air filters, two of which are American Cycoil and two Maxim; two Maxim exhaust silencers and two Burgess Snubbers; Manzel force feed lubricators; Marley cooling tower; Pittsburgh fuel meters and, for the last three engines installed, Pickering isochronous governors. The switchboard, furnished by the Electrical Engineering and Construction Company, is fitted with General Electric switchgear and instruments.

* *Former Superintendent, Greenfield, Iowa, Municipal Utilities.*

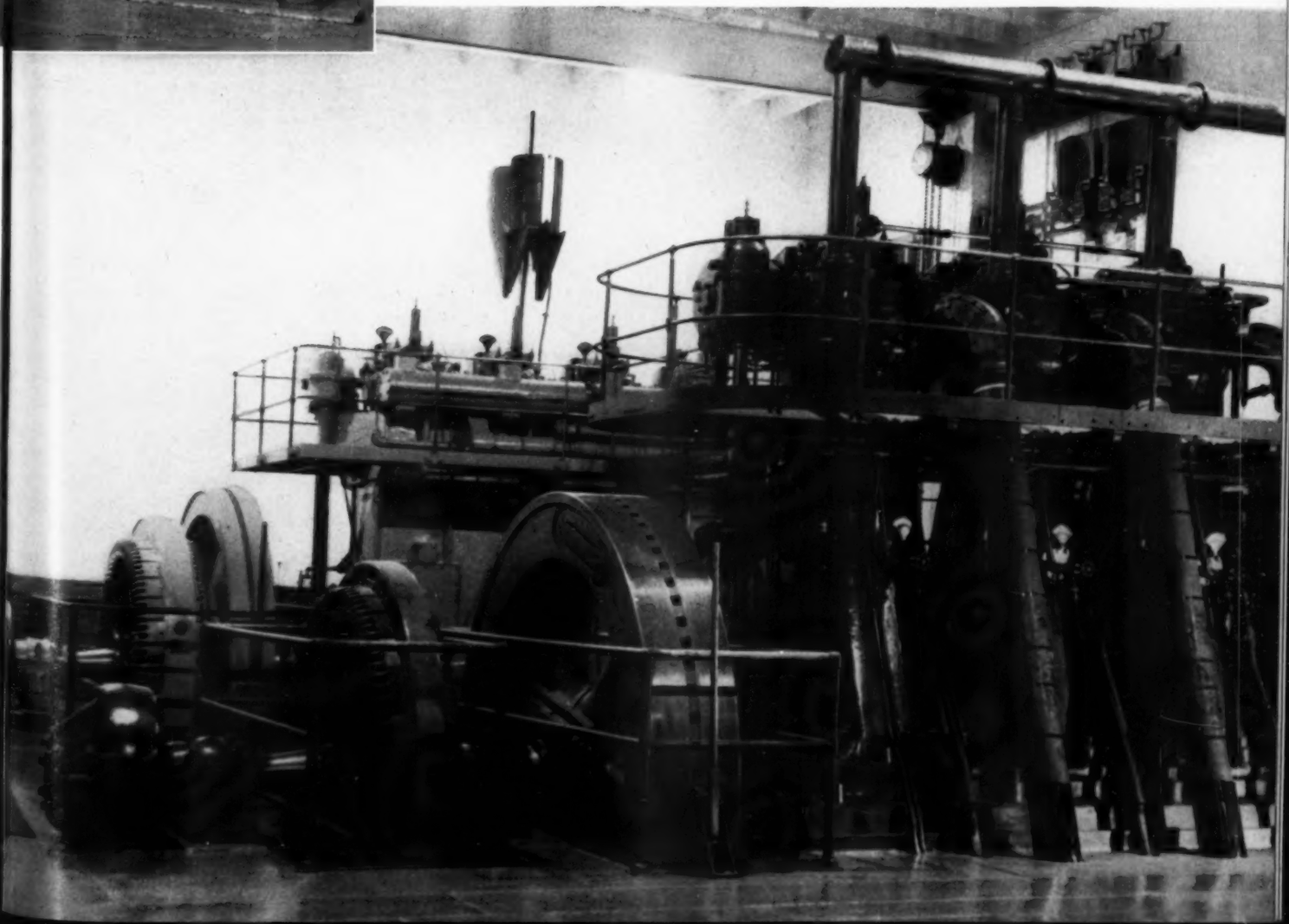




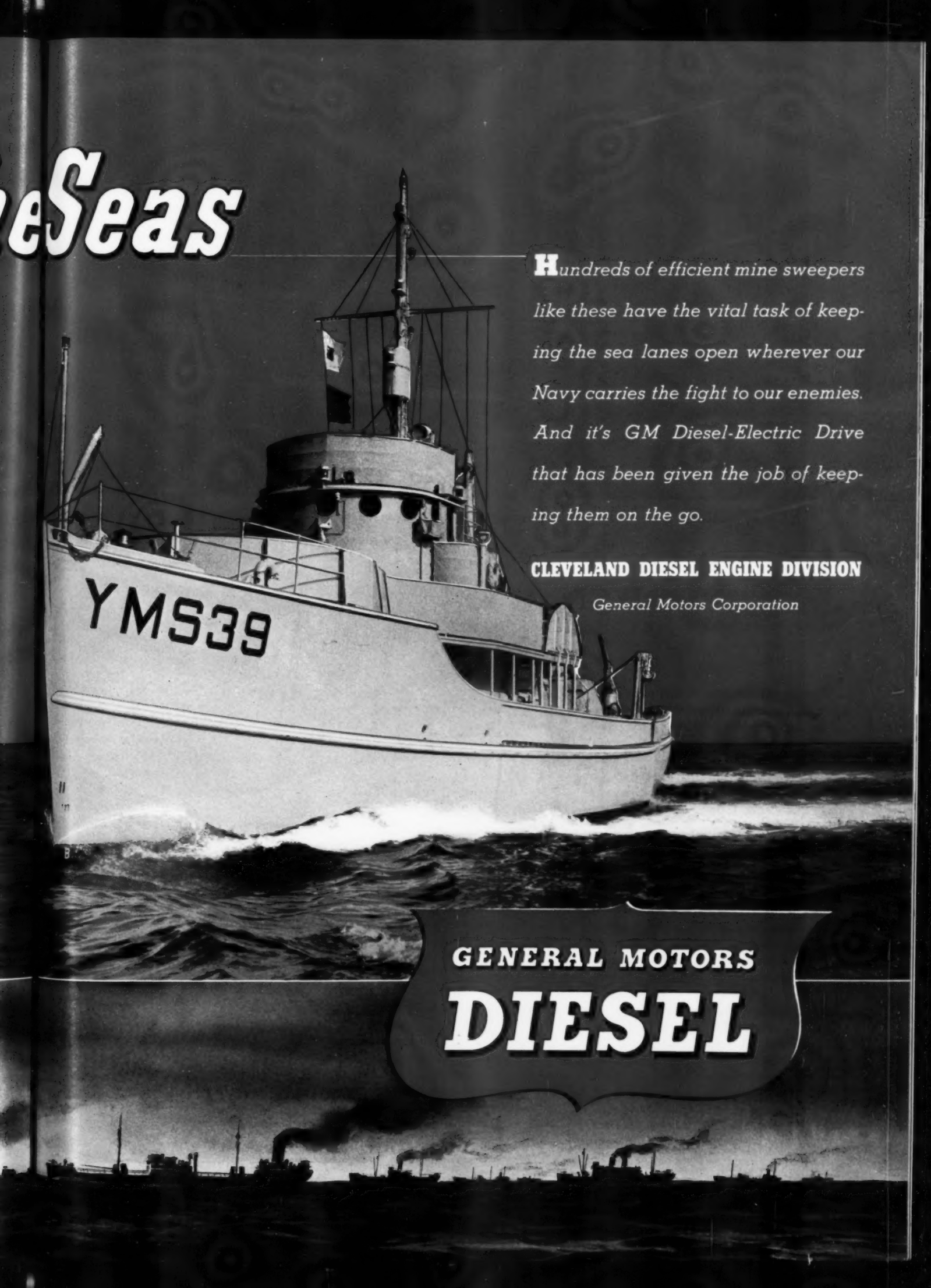
Above: Greenfield's modern power plant and city building. The large generating unit, top left, is one of two identical Fulton Diesels and General Electric alternators installed in 1940 and 1942.

Left: This Marley induced draft cooling tower handles the cooling of four Fulton Diesels in this plant.

Below, foreground: First Diesel installed in the Greenfield plant in 1924, a Fulton, 3 cylinder "A" frame engine and in the background is seen the second unit, added in 1925.



Sweeping theSt


eSeas
YMS39
Hundreds of efficient mine sweepers like these have the vital task of keeping the sea lanes open wherever our Navy carries the fight to our enemies. And it's GM Diesel-Electric Drive that has been given the job of keeping them on the go.
CLEVELAND DIESEL ENGINE DIVISION
General Motors Corporation
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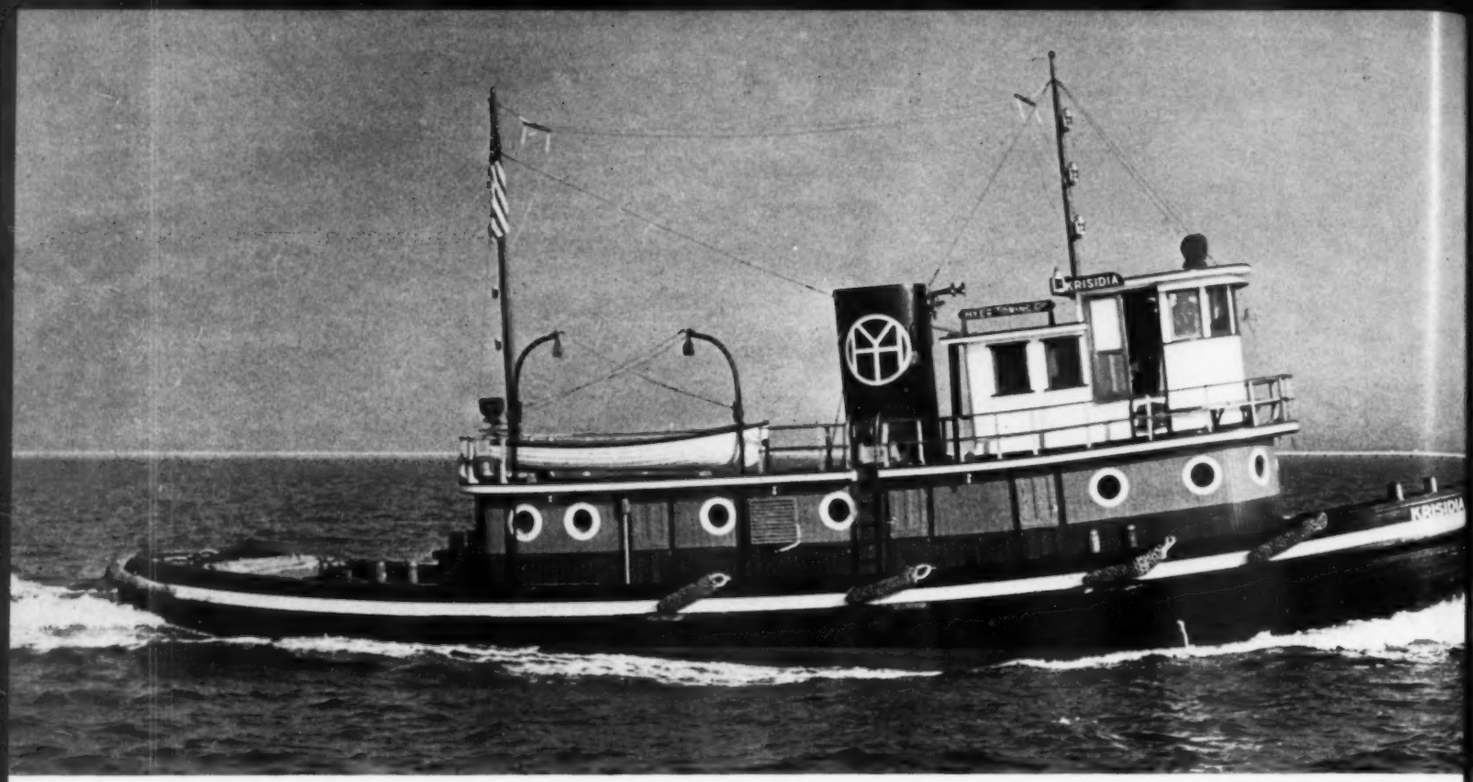


This sturdy wooden hull tug is the Hyer Towing Company's answer to the urgent need for steel and steel workers in other fields today.

WOODEN HULL DIESEL TUG

By WARREN GLEASON

NECESSARY diversion of steel plating to the innumerable defense projects is of unexpected benefit to the boatbuilding industry. The shortage of metal is reminding prospective owners that mighty fine ships used to be built of wood, and incidentally that there are many fine craftsmen still available who well know how to put wooden boats together.

Take the tugboat *Krisidia,* for instance. The Hyer Towing Company of Pensacola, Florida, needed another tugboat in its fleet. Shortage of steel plating and the equal scarcity of steel workers and welders seemed to render steel construction somewhat difficult. Accordingly, attention was turned to wood and the resulting design and construction has brought about a modern tug equal to the best afloat.

Krisidia is no small tug. Her overall length is 85 ft. with a moulded beam of 22 ft. and an actual beam of 22 ft. 6 in.; the draft forward is 6 ft. 6 in., and 9 ft. 6 in. aft; tonnage is listed as 113 gross and 78 net.

One stick of heart long-leaf pine, 72 ft. long, sided 12 in. and moulded 15 in., forms the keel; finding such a stick as this is not so easy nowadays but it can be done. The frames are sawn, doubled, finishing 6 in. by 12 in., spaced on 2 ft. centers forward and aft and on 18 in. centers amidships. This is sturdy construction.

To support the weight of the propulsion engine are two timbers 15 in. by 19 in., each 47 ft. in length and resting on athwartship timbers which together with the engine timbers are through-bolted to frames and keel. Solid? Say! But wait.

Solid chunks of live oak, selected in natural crooks, form the stem, stern post, shaft log, deadwood, and the rimlog of the transom. The stem, in one piece from keel to loggerhead, is sided and moulded 16 in. by 16 in. A heavier stick, 18 in. by 20 in., forms the stern post; the shaft log is one piece 14 in. by 14 in.

The lads who planned and built this hull must have remembered old sailing-boat construction, for the hull is reinforced throughout with live oak knees sawn to the natural curve; at the stem are four breast hooks, one above decks and three below, all these hooks likewise of natural curve live oak. Deck beams are substantial, sided 4 in. and moulded 10 in., with hatch coamings 6 in. by 20 in. To form a lasting fastening between deck beams and the frames, natural crook juniper knees are bolted through frames and beams; no ordinary "jogging over" on *Krisidia.* The building job was done in Pensacola, under the personal supervision of Captain Hyer of the towing firm.

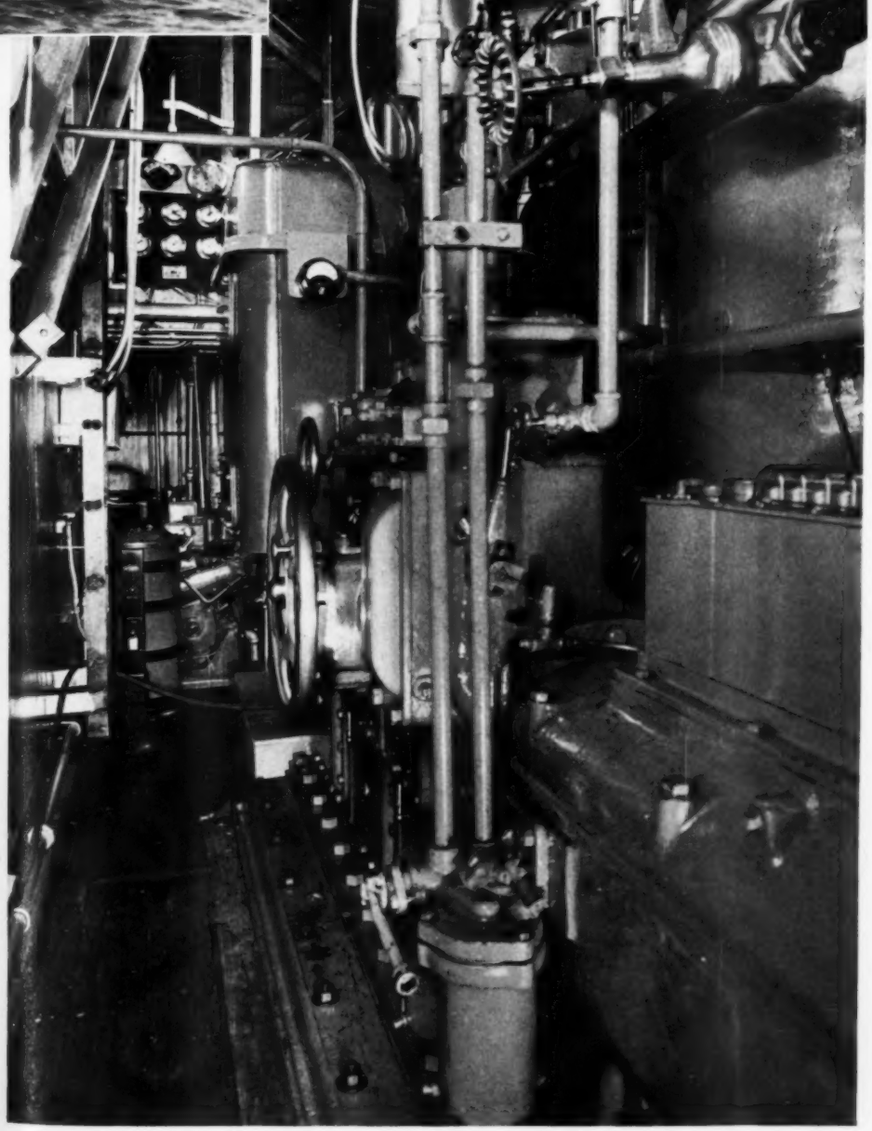
The power plant is as substantial as the boat that carries it. In another tug, owned and operated by the company, a Fairbanks-Morse Diesel of 500 hp. had rendered excellent service, so a duplicate was installed in *Krisidia.*

This main engine is a Fairbanks-Morse 5-cylinder, 2 cycle Diesel, developing 500 hp. at 260 rpm., turning a three-blade ovid bronze propeller 82 in. diameter by 42 in. pitch, designed by A. J. C. Robertson of Fairbanks, Morse & Co. Fuel injection system is of the Fairbanks-Morse design which provides an individual pump for each cylinder.

For accessories, every necessary modern device has been installed for complete protection of

Another member of the Hyer fleet, "Juno," lately repowered with a Fairbanks-Morse Diesel.

Control stand of the F-M main engine; note Alnor pyrometer, Weston tachometer, and Honan-Crane lube oil refiner.



the power plant. Nugent Duplex filters protect the fuel line; a Crane refiner provides continuous purification of lube oil with its original lubricating properties restored; an Alnor Pyrometer indicates engine exhaust temperatures; the engine is fitted with a Madison-Kipp lubricator. Ross heat exchangers handle engine and lube oil cooling; a Schutte & Koerting oil strainer is fitted to the oil line.

The auxiliary unit is also Diesel, being a Fairbanks-Morse, one cylinder, 10 hp. Combined with this Diesel is a generator, a 10 cfm. F-M compressor and a 70 gpm. F-M pump for fire and bilge service. The unit is a factory-built job, carefully engineered, with all component machines mounted on one common base. For further electric current, a 5 kw. F-M generator, 120 volts, is V-belt driven from the tail-shaft.

Other equipment includes a Marshalltown gauge board in the engine-room; two 600-42 F-M water systems for fresh and sanitation water; Edison storage batteries; switchboard by H. Listenwalter & Co.; an RCA ship-to-shore phone is installed in the pilot-house.

Performance of hull and engine has been entirely up to expectations. A free-running speed of 12 mph. has been clocked over a measured course; dynamometer test of engine thrust registers 18,000 lbs.

The engine is remarkably steady on its foundations, with no vibration being noticeable; the wooden hull is decidedly a success. The tug is now in regular towing service between Louisiana and Florida ports.

Another Diesel tug operated by the Hyer Towing Company is the *Juno,* measuring 83 ft. 6 in. by 18 ft. 5 in. beam and 8 ft. 6 in. draft, built of riveted plates of charcoal iron. The designer and builder was John Dialogue of Camden, New Jersey. The year, 1879!

The original power plant of the *Juno* was steam, of course. It served until 1938, when the tug was re-styled and re-powered to become as sightly and serviceable a tugboat as the most modern-minded might desire. It is interesting to note that the Fairbanks-Morse Diesel in this tug turns the same propeller formerly driven by the steam plant. The old engine was slow-turning, of about 200 hp., but the propeller proportions coincided with the higher speed and power requirements of the new Diesel and performance has been quite satisfactory. *Juno* is a sleek craft with a clean wake, and looks to be good for another 63 years.

TYPICAL of the application of Diesel electric drilling rigs are those operated by the Rowan Drilling Company, Fort Worth, Texas. Experience with these Diesel-driven outfits has proved the flexibility of the Diesel electric rig, the electrical equipment comprising the variable voltage transmission type, and its efficiency and feasibility under many severe operating conditions encountered in the Southwestern and Gulf coast regions. Two outstanding operations are the rigs of this company designed to operate aboard barges for drilling wells in the marshy coastal regions in the lower Mississippi delta section of Louisiana. The first two rigs originally designed for this operation were powered with two Cooper Bessemer Diesel electric sets having a total of 400 kw. generating capacity. The generating units for one of the rigs consisted of two 200 kw. generators on a common shaft to which were connected two Diesel engines through V-belt drive. The generating unit for the other rig was a 400 kw. generator V-belt driven by two similiar Diesel engines. To each of these rigs were later added two Diesel-generating sets each, with the engines direct connected to the generators, making four engines to each rig, and affording each drilling rig a total of 800 kw. generating capacity. The original engines on the first rig were two 6 cylinder Cooper-Bessemer Diesels having a 9″ bore and 12″ stroke, and developing 250 hp. each at 600 rpm. The two engines later added were 8 cylinders, 300 hp. Diesels of the same make. The original engines drive 1200 rpm. 200 kw. 200 volt dc. generators, the other two engines are driving direct connected to 200 kw., 400 volt dc. generators. The equipment is operated in the following manner:

While drilling, one 200 kw., 200 volt generator is used for the rotary when just rotating. The other 200 kw., 200 volt generator supplies power to the motor on the 7½″ x 18″ mud pump. The two 200 kw., 400 volt generators are operated in parallel, supplying the 400 hp. motor driving the mud pump. When coming out of the hole the two 200 kw., 200 volt generators, operated in series, are paralleled with one of the 200 kw., 400 volt generators.

On the second rig, the two 8 cylinder, 300 hp. Diesels are used in connection with two 300

DIESE

Rowan Drilling Co. barge-mounted rig with Cooper-Bessemer Diesels and Westinghouse variable voltage DC drive on location near La Fitte, Louisiana.

hp. Diesels of slightly different type. The latter two engines drive one 400 kw., 400 volt generator, each of the former two being direct connected to a 200 kw. generator. Normally this rig is operated as follows:

The two engines driving the 200 kw., 400 volt generator are used on a 400 hp. mud pump. One of the engines driving a 200 kw., 400 volt generator is used to drive the rotary table. Coming out of the hole, the generator units are used as follows: One 400 kw., 400 volt generator is operated in parallel with a 200 kw., 400 volt generator. These three engines and two generators supply power to a 400 volt., 400 hp. motor driving the drawworks. The other engine driving a 200 kw., 400 volt generator supplies power to the mud pump.

The practicability of the Diesel electric drilling rig for operating under severe conditions may be credited to two important developments of the present day engineering experience in these fields; namely, the high-speed Diesel engine of adequate size and the perfection of the variable voltage transmission.

The type of Diesel-electric rig described, with its variable voltage transmission, comprises many advancements made in recent years in the electrical and Diesel fields. Fundamentally, the arrangement comprises direct current generators, a portion of whose fields are supplied by separate excitation and whose voltages are varied or reversed by controlling their fields. Also included are motors with shunt fields separately excited, so that their direction of rotation and speed can be changed when the value and polarity of the generator terminal voltages are changed, together with constant voltage exciters to provide for separate excitation, and added generators and motors for auxiliary power. In connection with this electric equipment is also included special control equipment capable of full control of power application to all the main motors for drilling and hoisting directly from the drillers position. There are numerous advantages of the arrangement of this kind, some of which are worth enumerating here. The generators are not only variable voltage generators, but have a characteristic voltage curve that drops to zero at some predetermined value. The purpose of this is:

1. The peak generator output and consequently the peak demand on the engines is eliminated, or limited to the actual output of the Diesel engine.

2. Once this limit is established, the protection of the engine against overload is automatic regardless of table, pump, or hoisting load.

3. The maximum current when the motor is stalled is limited to that value which is safe for the mechanical and electrical equipment, a limitation that is essential for the mud pump and table drives.

A Diesel-electric drilling rig of this type is usually known as the "full Diesel-electric rig." In operating this type of drilling rig, the draw works, table, and mud pump are all driven electrically. The table may be driven, however, by the draw works motor through the draw works, or by a separate table motor as in this case. The pumps may also be driven mechanically, in which case the rig would be known as the "semi-electric." This type of modification is frequently used in the field. The chief characteristics of a variable voltage, direct current transmission equipment for oil well drilling may be summed up as follows:

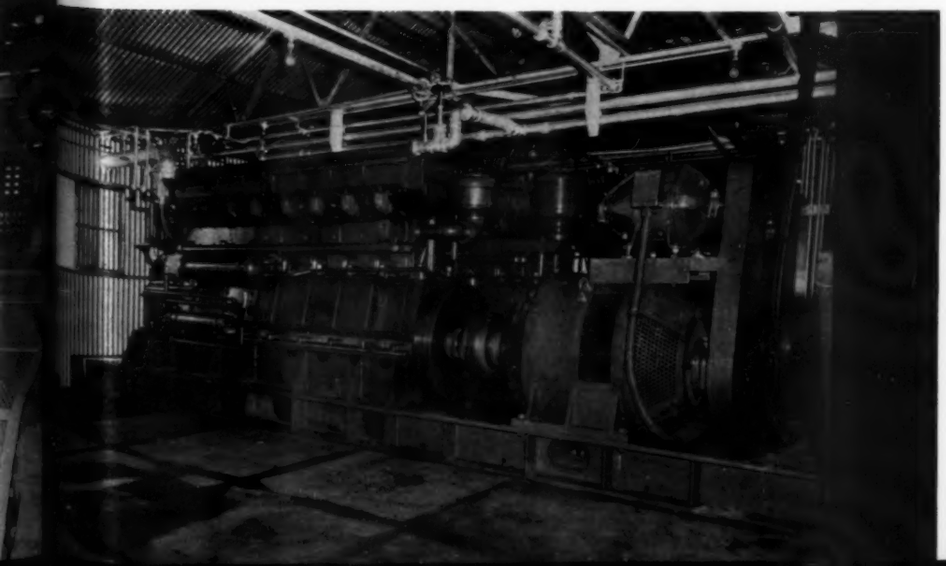
1. There is no manipulation of a clutch to pick up the load, the clutch being used only when starting the engines. This cuts down the usual expensive clutch maintenance common to this service, also the time due to delay in starting the engines. It also eliminates the shock loads on the engine and the mechanical equipment that usually accompanies clutch operation to pick up the load.

2. It is, therefore, practically impossible to overload or stall the Diesel engine, and thus engines can operate at practically constant speed regardless of the load, a condition that is most desirable if the engine is to give the maximum efficiency and the installation kept down to a minimum of complications in control equipment. The load can be picked up smoothly and quickly and, due to the inherent characteristics of the electrical control, avoid shocks and loads on the engine and the mechanical equipment that do damage to the unit. It is evident that a wide range of motor speeds and torques are available. The voltage at light loads and operating speeds when lifting such loads may be as much as 15 to 25 percent above the rated speeds. It is also feasible to handle full-load torques satisfactorily at several speeds, ranging all the way from zero to full speed, something not possible with any other arrangement so far used in practice. In the field on actual operation, it has been found that torques from 40 percent to 200 percent of full load torque can be exerted at zero speed, since the maximum torque at zero speed can be predetermined.

The Diesels used on these rigs are of the stationary type, and are found in the 6 cylinder and 8 cylinder units. The base and counterframe of these engines are cast of Meehanite metal in one piece and the installation is very rigid. Power cylinder liners are of the wet type, and are convertible to gas operation by changing cylinders. The engines are fully equipped with a number of essential auxiliaries, which include air filters, silencers, oil and fuel filters, gauge indicators and thermometers. The use of simplified auxiliary layout has been shown to be desirable, since the arrangement is virtually a portable application, and may be moved considerable distance quite frequently.

Built in auxiliary equipment is preferable, and in many cases practically all needed equipment of this kind is attached directly to the engines. The operation of these two rigs in the Mississippi Delta on barges under adverse conditions provides a wide range of flexibility, adaptability, and performance tests which indicate adequacy of this type of equipment. On such locations, completely self-contained rigs having high flexibility and reliability are as important as low operating costs. Both have been attained in these rigs, and a new standard for measuring operating costs and oil well drilling practice has been set up.

One of the 370 hp. Cooper-Bessemer Diesels with direct connected 200 kw. generator and top mounted exciter.



The Atlas Manufacturing Co. machine shop, above, is operated around the clock on power from two Diesel generating sets, left, saving 60% of power cost.

SAVING 60% WITH DIESELS

AT the western edge of Chesterton, Indiana, where gleaming streamliners and laboring freight trains take a final breath before plunging on to Chicago, the Atlas Manufacturing Co., owned by Mr. J. C. Saidla, is banging away, twenty-four hours a day.

Around-the-dial operation of a company that turns out essential screw machine products isn't the only reason why bright fingers of light reach out from the plant at night. For, while the night shift of workers toils in the first floor machine shop, gay youngsters from Chesterton and surrounding countryside cavort overhead on roller skates. And, if the second floor roller rink doesn't happen to be in operation, there's the tramp and shuffle of feet from bingo players who gather in front of a built-in stage for regularly scheduled evenings of play.

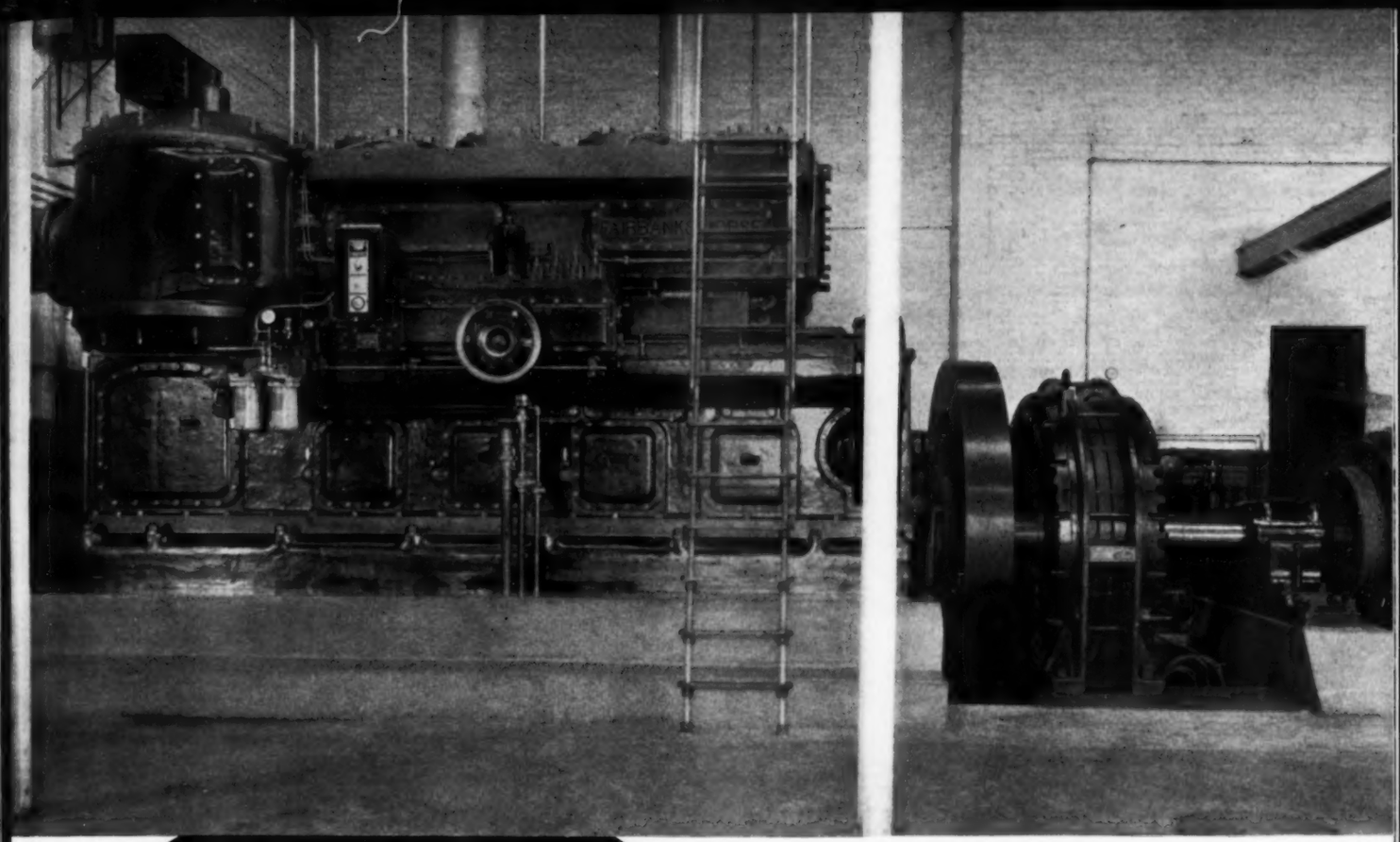
Seeing the twenty-four hour operations of Mr. Saidla's shop, which includes nineteen automatic screw machines among its extensive equipment, and noting the blaze of light from a total of 130 100-watt lamps which light the second floor, the casual observer might congratulate himself upon not having Mr. Saidla's monthly electric power bill in his mailbox.

Mention power cost, though, and you receive a cheerful smile from the owner of Atlas Manufacturing Co. For Mr. Saidla has "gone Diesel" and furnishes all his electricity by use of two 88-50 self-regulating Caterpillar Diesel-electric sets, installed August 1, 1941.

Before turning to Diesel, Mr. Saidla's average monthly bill for purchased electricity was approximately $320. After installation the monthly cost dropped to approximately $70, with the engines alternated for two-week periods.

By December 1, 1941, the electrical load had been increased greatly. Besides additional work in the machine shop, where all driven machinery is powered by Diesel-generated electricity, added hours of seasonal darkness, and operation of a water-pumping plant and boiler feed and vacuum pump, Mr. Saidla calls on his electric set to provide lights and power for the rink and bingo theatre, his modern apartment located on the first floor, three new houses for employees built on the factory grounds, and eighteen 100-watt floodlights decorating the front border of his property.

At present, power costs average $180 per month. "The way we use electricity now, our purchased power bill would run about $700 a month," Mr. Saidla estimates. "That's a saving of some $420—and I save an additional $12 to $14 a month by having my own water plant now, instead of using the city service." Plenty of water for the plant, houses, and grounds is furnished by a 1000-gallon pump. Mr. Saidla's electric sets use 2.86 gallons of 7c fuel per hour.



This 700 h[p.] ... for the Greenville Cotton Oil Works, has cut power cost 70 per cent. N[ew] ...

IN recent years, the cottonseed oil industry has given increasing attention to the Diesel as a source of both power and heat for mill operation. Not only has the Diesel proven to be the most economical power producer, but it insures additional savings through use of waste heat to cook seed, an essential process in the oil production. One of the most modern, flexible, and economical power plants in the industry was put into operation in October, 1940, at the Greenville Cotton Oil Works in Greenville, Mississippi. The prime mover is a 700 hp., two-cycle, pump scavenging Fairbanks-Morse Diesel delivering its rating at 300 rpm., direct connected to an F-M 300 kw. generator.

Before installation of the new engine, the Greenville mill operated a 500 hp. steam engine to drive the main line shaft and, in addition, purchased power for a score of motors totalling 785 horsepower. The cost of crushing a ton of seed with this steam-electric plant averaged $1.10. After a year of experience with the new Diesel plant, Superintendent B. C. Lundy reports that the cost of crushing a ton of seed is now just $.30, a saving of more than 70 per cent. The utility had offered a rate of 1.5 cents per kwh. if the company would electrify the entire mill. Mr. Luncy calculates that

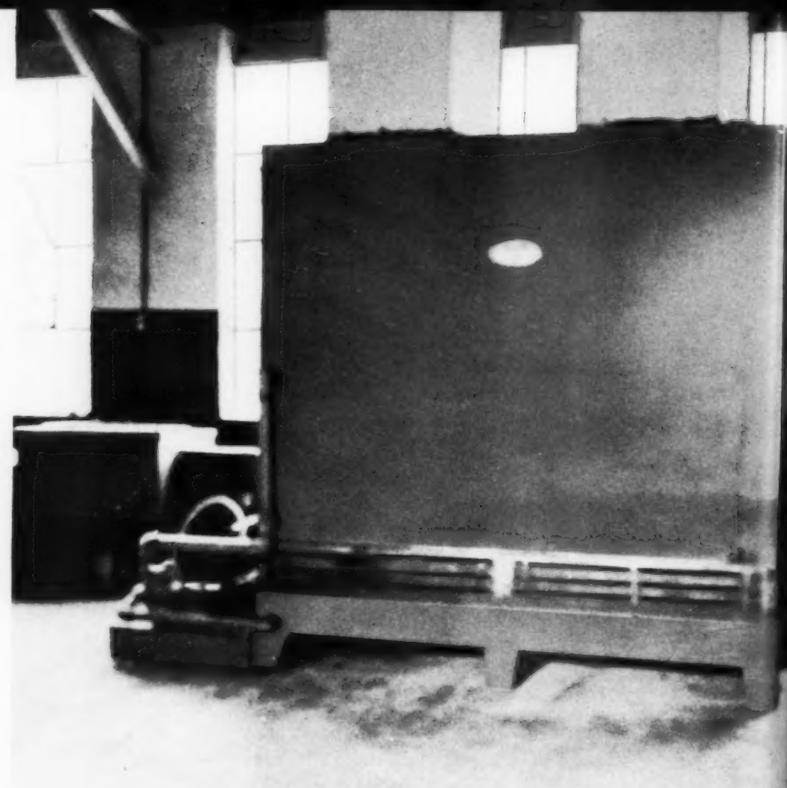
the total cost of producing power with the Diesel (including fuel, lubricating oil, maintenance, labor, and depreciation) is only 5 mills per kwh. To this saving must be added the considerable item of heat for cooking seed.

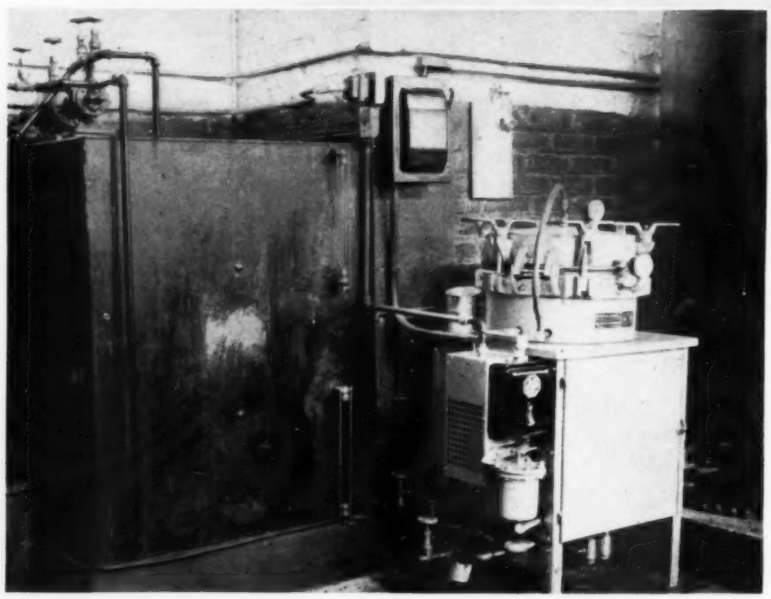
The power arrangement at the Greenville mill provides the utmost flexibility in operation and permits the most efficient utilization of engine capacity. The Diesel is direct connected to a 300 kw. alternator with belted exciter. The engine also drives, through a shaft-type clutch coupling, a jack shaft to which the main mill line shaft is belted. The mill has a rated capacity of 100 tons of seed each twenty-four hours and production procedure in the industry is such that all phases of mill activity need not and do not proceed concurrently to reach the capacity rating. For example, the activity of seed unloading usually is concentrated in the first months of the season. The main mill may be idle during the initial period and reach its peak later in the season.

With these factors in mind, the plant designers provided alternate drives for both the press room and the screen room. When the main mill is in operation, both these rooms are driven from the main line shaft, bringing the total belted load to 500 horsepower. When the main mill is idle, however, the press room can be run by a 150 hp. motor and the screen room can be operated by a 50 hp. motor. Like all the motors in the plant, these derive power from the engine-driven generator. All other equipment is motor-driven exclusively, there being a total of twenty-three motors ranging from 5 to 150 horsepower.

It is evident, immediately, that the main mill and all the motors could not be run at the same time for the total load would be 1085 horsepower, but since this is neither necessary nor desirable, it is possible to satisfy all actual requirements with a 700 hp. engine. Furthermore, the arrangement makes for flexibility and efficiency. The operator can always devise a schedule to insure balanced production. He may unload seed during the day and grind meal at night, or he may unload through the day and cool seed at night. He never finds it necessary to run a piece of equipment unless there is work for it to do. He is able to arrange his schedule of activities to give the engine an excellent load factor. A total cost of 5 mills per kwh. gives ample evidence of the resultant engine efficiency.

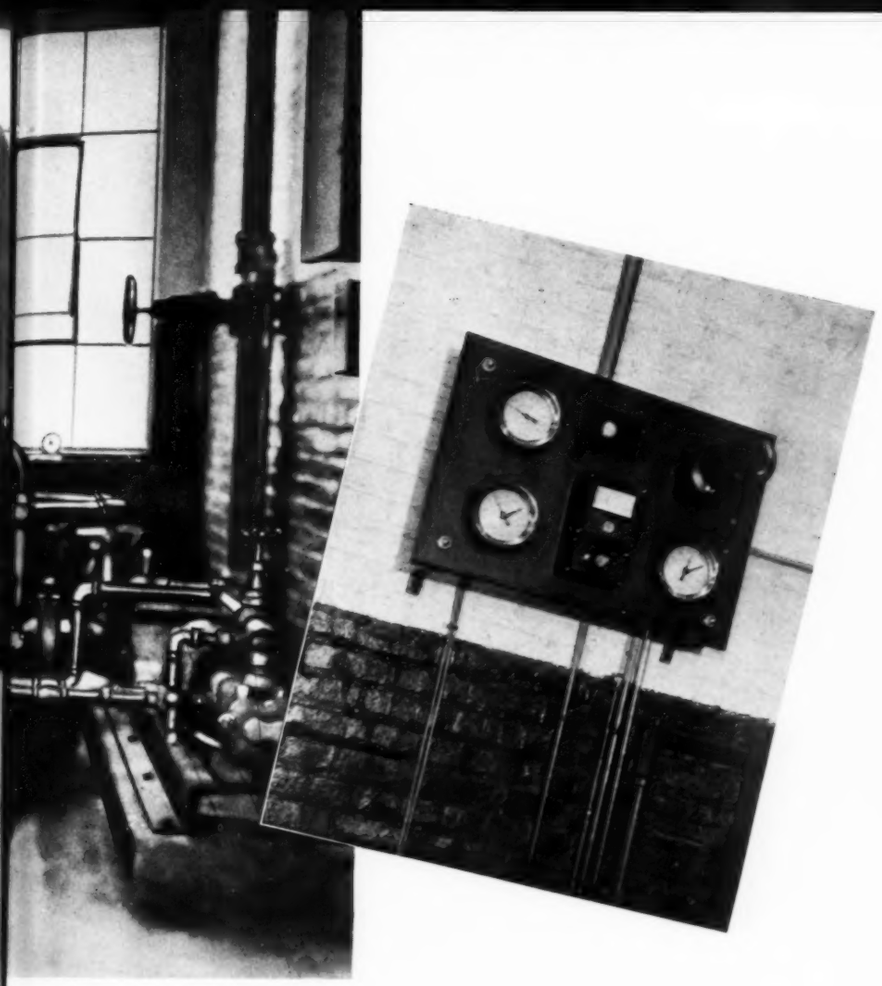
During the season, which lasts usually for six to eight months, the power plant runs continuously, twenty-four hours a day, seven days a week. The Greenville mill has no standby service except a 7½ kw. line to serve an emergency lighting system, a small pump and a compressor. It is essential, then, that the plant be designed carefully to insure steady, trouble-free operation.





The four cylinder engine, with 16 in. bore and 20 in. stroke, operates on the two stroke cycle. Scavenging air is drawn in through a 40 foot stack (to avoid dust near the ground) down through six Midwest impingement type filters enclosed in a concrete house, just outside the engine room. The filtered air then reaches the suction of the large built-in scavenging pump that insures thorough scavenging of all four engine cylinders.

An F-M evaporative cooler, inside the engine room, cools both jacket water and lubricating oil. Soft city water is circulated through the engine jackets and a set of coils in the evaporative cooler by a motor-driven F-M centrifugal



Above: The Fairbanks-Morse evaporative cooler and circulating water pumps. This is a combination unit handling engine jacket water and lube oil cooling.

Left: This Hilco unit is arranged for continuous purification of lube and piston cooling oil.

Upper right: Panel carrying oil, air, and water gauges, alarm, and Alnor pyrometer.

pump. The closed system gives maximum protection against formation of scale. Lubricating oil, which also is used to cool the engine's piston's, flows through a second closed circuit in the cooler. Lube oil is supplied to the bearings under pressure by an engine-driven pump and a large quantity of this oil is forced up into the pistons for cooling. A Hilco activated clay purifier is arranged for continuous operation and keeps the lubricant free of impurities. It is never necessary to drain the crankcase and discard the oil. One of the features of this installation is the pair of F-M auxiliary pumps, a motor-driven rotary pump for lube oil and a motor-driven centrifugal for jacket water.

Both these pumps are run for a few minutes before the engine is started, in order to bring up lube and water pressure. The auxiliaries are operated again for a few minutes after the engine is shut down, to insure slow and adequate cooling. The pumps could be used, also, in the event that the main circulating pumps failed.

Fuel is unloaded from tank cars by a motor-driven rotary pump into storage tanks with a total capacity of 24,000 gallons, above ground, 250 feet from the engine. The fuel flows by gravity to a 300 gallon day tank below ground just outside the engine room. A transfer pump built into the engine draws oil from the day tank through a Nugent duplex cartridge type filter and supplies the fuel to the individual injection pump for each cylinder. The quantity of fuel injected is regulated by a Woodward relay-type governor.

The handling of the exhaust gases is a matter of considerable importance at this plant. The system of heat recovery and the system of cooking seed with hot water (an innovation in the industry) were designed by R. D. Williams of the Fairbanks-Morse staff. The exhaust gas, at 500 deg., passes from the engine header into the top whorl of a waste-heat boiler supplied by the Dan Shea Boiler Works. The boiler is 60 in. in diameter, with a 20 in. stack in the center, and eighty 4 in. tubes in the outer space. The hot gas enters at the top, flows down around the tubes giving up its heat to generate from 80 to 100 lbs. of steam, then passes up the center stack to the atmosphere.

The boiler is arranged in parallel with a 20 hp. gas-fired boiler which gets up pressure when the mill is started and then flows on the line, supplying whatever additional heat is needed. Water is heated to 300 deg. and circulated through the seed cooker. The use of water instead of direct application of steam permits easier regulation of heat with smaller fluctuation and provides an evenly-cooked product without keeping a man in constant attendance. The waste heat boiler, incidentally, also serves as an effective exhaust muffler.

As a protection for the engine, an alarm panel has been provided by Fairbanks-Morse. This includes an Alnor multi-point exhaust pyrometer and pressure gauges for lubricating oil, cooling water, and scavenging air. The howler sounds if lube oil pressure drops below 9 lbs. or jacket water goes beyond the 9 to 36 lb. limits. There is also a well-equipped switchboard with Westinghouse voltage regulator and oil circuit breaker.

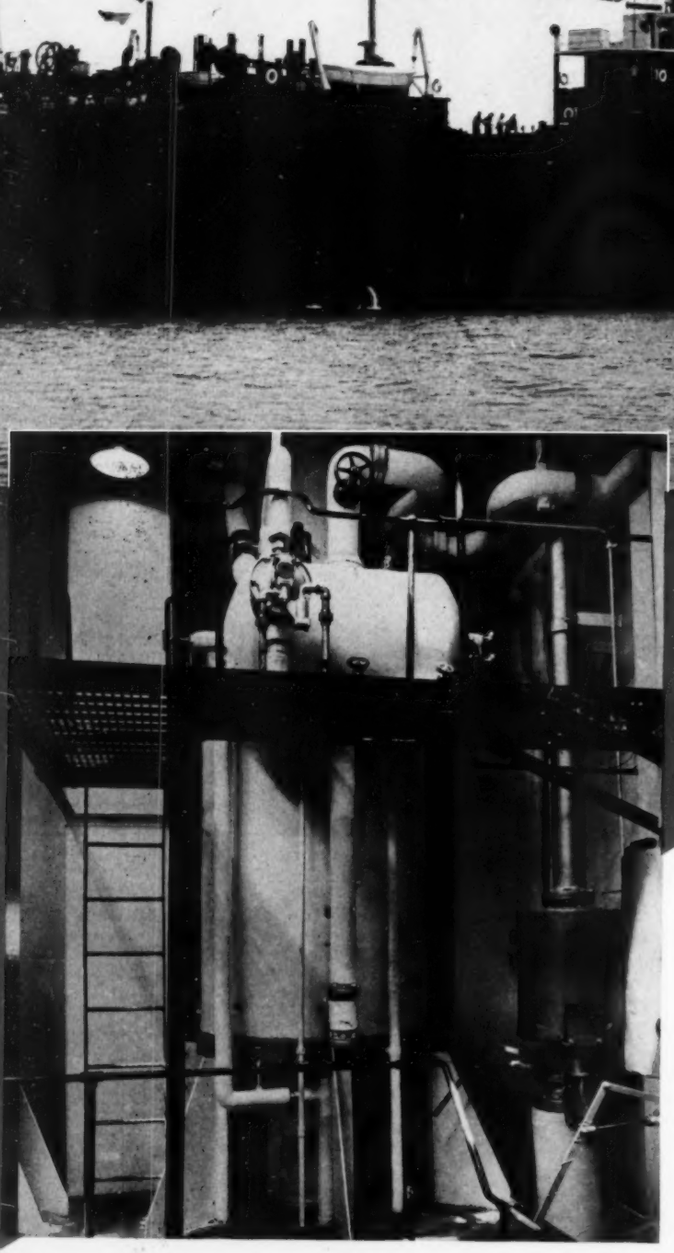
Designed for dependable and economical service, and operated carefully for peak results, this plant is making an impressive record of low-cost power production. The use of waste heat further enhances plant efficiency and provides additional financial benefits to the owners of the Greenville Cottonseed oil mill.

The two top views show the LeTourneau equipment used in building one-half mile of new railroad bed near Del Mar, California. In order to handle the 160,000 yards of damp sand earthmoving, Contractor T. M. Page uses two LeTourneau Super C Tournapulls powered with Model 6-DH-691 Buda Diesels, two Carryalls, two 'Dozers, and a Rooter. The Tournapulls are pusher loaded downhill and are making a 2400 ft. round trip haul.

One of two LeTourneau Super C Tournapulls working on a 450,000 yard airport project in Hinds County, Mississippi. Airport will have three 4,000 foot runways. LeTourneau equipment on the job: Two Super C Tournapulls, six Carryall Scrapers, three 'Dozers, two Sheep's Foot Rollers, and a Rooter. The Tournapulls are powered with Buda Diesels, Model 6-DH-691.

DIESELIZED HEAVY EARTH MOVERS

Constructing bridge approach fill on the east side of the Illinois River north of Peoria, Illinois. Clark Bros. Construction Co. uses three LeTourneau Super C Tournapulls each powered with a 130 hp. Buda Diesel, Bulldozer, H Rooter and Sheep's Foot Roller on this 200,000 yard project. Tournapull loading is assisted with D8 pusher.



Diesel tanker, "William C. McTarnahan," owned by National Bulk Carriers, in which a Maxim combination spark arresting exhaust silencer and waste heat boiler is giving excellent results. To the left is a view of the waste heat boiler installation.

SOMETHING NEW ON WASTE HEAT RECOVERY

By W. R. WILLIAMSON*

WASTE heat recovery has until recently been treated merely as an adjunct to a standard line of boilers, a line designed and standardized to meet entirely different conditions, especially when viewed from the standpoint of waste heat recovery from the exhaust of an internal combustion engine. As an example of this misapplication, attempts were made to control the output by controlling the fire, as this was the procedure in the control of a direct-fired boiler. The actual source of the fire for a waste heat boiler on an engine exhaust, however, takes place in the engine cylinders, and this is controlled not by a *heating* or *steam* load, but by a *power* load. The natural step, therefore, in the control of a conventional boiler applied to the exhaust of an engine would be a by-pass arrangement for the exhaust gases. This was a logical answer, but such a by-pass arrangement usually requires the use of an extra silencer and especially designed blast gates to withstand the heat of the exhaust. An arrangement of this sort was not very adaptable to automatic control, as considerable power was required to operate the heavy blast gate, which often clogged with carbon and jammed. Controlling the heat input in order to control the heat output presents, therefore, certain difficulties so far as its application to waste heat boilers for the exhaust of internal combustion engines is concerned. From an examination of the basic heat transfer formula $Q = UA\theta m$, where Q = Heat Transfer in Btu/hr.; U = Overall coefficient of heat transfer in Btu./h./sq.ft./°F.; A = Effective contact area in sq.ft.;

* *Engineer, Maxim Silencer Company.*

θm = Mean temperature difference between fluids, we find that the heat output can be varied by varying any one of three factors, if heat input is fixed, as is the case of an engine exhaust boiler not utilizing a by-pass. "U" can be varied somewhat by changes in the velocity of either fluid, and "θm" can be varied somewhat by varying the mean temperature differential between the fluids. It is found, however, that so far there has been no practical way of varying these factors and very little control can be exercised. The effective contact area, however, can be varied by the simple expedient of raising or lowering the level of one of the fluids—in the great majority of cases this would mean the raising and lowering of the water level. Dropping the water level to vary the heating contact surface in an oil-fired boiler would bring about disastrous results, but such an arrangement as depicted in Figure 1 is entirely feasible in engine waste heat recovery due to moderate ranges of exhaust temperatures as compared to the metal melting temperatures in a direct-fired boiler. Inasmuch as power is being generated in the form of steam, and it is desirable to utilize this steam for actuating mechanisms, the use of pressure regulated valves has been resorted to.

The arrangement for automatic control of a boiler as shown in Figure 1 has proven very satisfactory in service. If steam in excess of the demand is being generated by the waste heat boiler, the pressure regulated valve "F" on the feed water line will close at a pre-determined pressure and shut off the water supply to the boiler. If the steam demand has undergone an abrupt change, the pressure will still build up in the boiler, and reaching another predetermined pressure, a reverse acting pressure regulated valve "D" will open and water in the boiler will be dumped to the accumulator, uncovering heating surface to an extent that steam will be generated in only sufficient quantities to meet the existing demand at pressures varying between the cut-off of the feed and the opening pressure of the valve to the accumulator. Feed water regulator "B" serves as a high limit control.

An example of this type of automatic control is the case of such an arrangement recently made on the exhaust of the after four cylinders of the Diesel 8-cylinder 1700 hp. Buchi supercharged port main engine in the National Bulk Carriers, tanker M/V *William C. McTarnahan*. A waste heat boiler was especially designed to meet the requirements of varying water level. Reference to Figure 2 will indicate the manner in which the principles of silencing and spark arresting have been incorporated in the waste heat boiler. Such a combination greatly reduces installation cost and provides a compact unit only slightly larger in diameter than a standard Spark Arrestor Silencer.

The waste heat boiler aboard the M/V *William C. McTarnahan* is operating under the most adverse conditions, as the vessel usually plies between a northern and a southern port. The heating load, therefore, during the winter months varies from a very high demand in the North to practically nil in the South. The pressure regulator valve "F" of Figure 1 was set to close at 16 lb., and the pressure regulator "D" was set to open at 18 lb. Under normal heating loads, the pressure varies between 15 lb. and 20 lb. At conditions of no heating load when the main valve from the boiler was closed, the pressure hunted over a range from 12 lb. to about 25 lb. due to the fact that when the small quantity of water necessary to keep up the steam pressure was admitted by valve "F", the pressure dropped somewhat due to the cold entering water and then built up a slight excess due to the fact that steam was going through the pressure valve "D" because the water level was slightly below this connection. In other words, the pressure regulating valve "D" was acting merely as a safety valve, and of course was of such a size that only a limited amount of steam could be discharged to the accumulator where it condensed through a submerged heater indicated in the accumulator tank in Figure 1. These operations were very satisfactory over wide ranges.

This waste heat boiler was found to recover 740,000 Btu.'s per hr. at 15 lb. steam pressure from a load of approximately 800 hp. on the after four cylinders or, in other words, the unit was generating approximately 1 lb. of steam per brake hp. hour developed. From the standpoint of silencing and spark arresting performance, the combination unit is the equivalent of a standard spark arresting silencer, giving high quality silencing and spark arresting. The dust particles collected in the spark box were as fine as flour.

Fig. 1. Diagram of hook-up of waste heat boiler with auxiliary boiler, and arrangement of water level and pressure control valves.

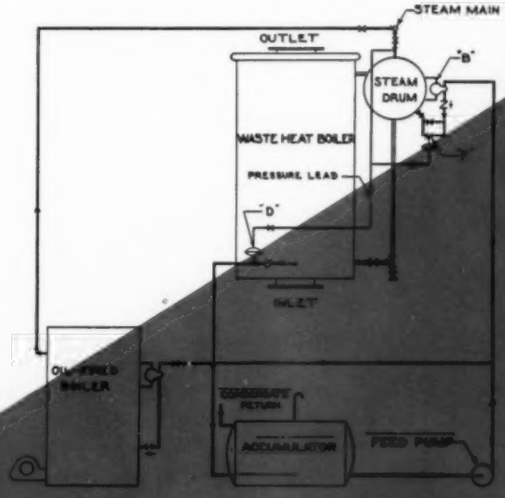
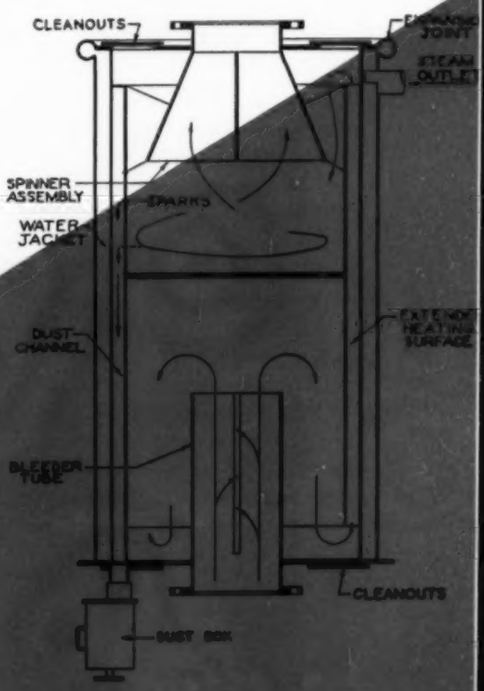
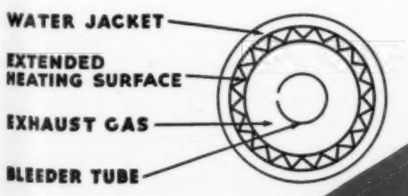
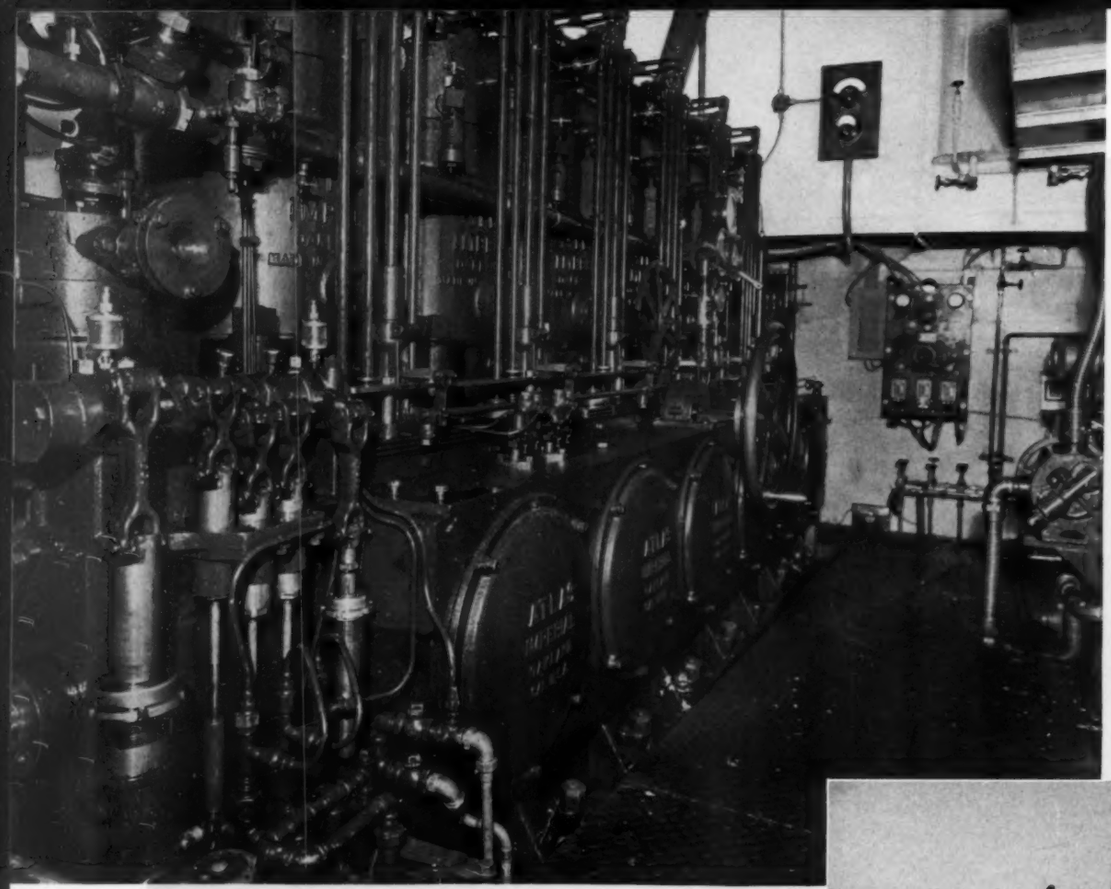


Fig. 2. Diagram showing how the principles of silencing, spark arresting, and heat recovery are combined in a single unit.



Sectional drawing showing the method of constructing extended heat transfer surfaces within a Maxim exhaust silencer.





Engine room view on the "Robt. E. Coppedge" showing the main engine, an Atlas 6-cylinder, 300 hp. Diesel. Note Weston tachometer and Alnor pyrometer high on the forward bulkhead.

Newest addition to the fleet of J. H. Coppedge and Company, Jacksonville, Fla., is this 73', all steel, all Diesel tug.

A NEW DIESEL GULF TUG

By WARREN GLEASON

ABOUT a year ago, J. H. Coppedge and Company of Jacksonville, Florida, took delivery of the smart steel tug *J. H. Coppedge* for the Coppedge towing fleet. Built at the Walker yards, this tug was approximately 70' overall and powered with a 300 hp. Atlas Imperial Diesel. Accordingly, therefore, it is no surprise that the latest tug for this towing firm, the *Robt. E. Coppedge,* was constructed at the same establishment.

As with the former tug, the contract for the new boat was placed with Arthur Duvic's Sons of New Orleans, ship chandlers, marine engineers and designers, and distributors of many lines of marine equipment including Atlas Imperial Diesel engines.

Hull design was by Arnold Walker of the building firm, with whom the contract for the hull was placed by the Duvics. The new tug is three feet longer than the preceding one, to allow more room for cabin space; otherwise, the general design is very similar to that of the *J. H. Coppedge.* The hull was towed to New Orleans where the Duvic organization made the engine installation, after which the craft was returned to Pascagoula where it received its finishing touches.

The propulsion engine is an Atlas Imperial Diesel of 6 cylinders, developing 300 hp. at 300 rpm.; fuel injection is by the Atlas common rail system. Engine equipment includes an Alnor exhaust pyrometer and a Weston electric tachometer; the exhaust is silenced by a Maxim spark-arrestor silencer connected to the exhaust manifold by Penflex metal hose.

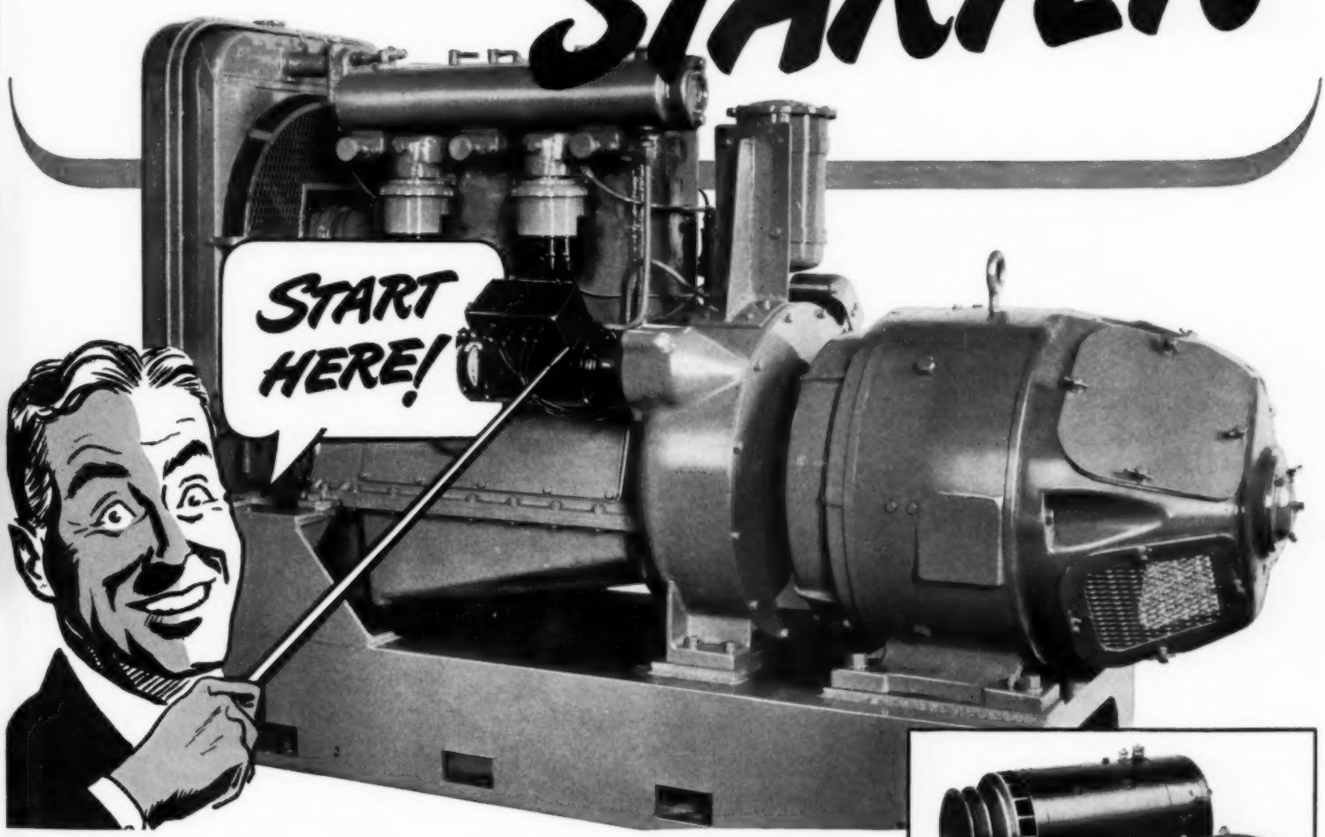
There are two sources of electric current for the boat's use; a Westinghouse generator is V-belt driven off the main shaft, with another generator in the auxiliary set. This unit, engineered by the Duvics, is made up of a one cylinder Stover Diesel driving the auxiliary generator, a Quincy 2-stage air compressor and a Viking fire and bilge pump. All members of the unit are mounted on a common structural steel base firmly built into the hull. Batteries are Exide Ironclad Marine type for a 32-volt system, with switchboard of Duvic specifications.

Both Captain and Mrs. J. H. Coppedge came from Jacksonville for the launching of the new tug, Mrs. Coppedge acting as sponsor and christening the vessel. It should be mentioned that the *Robt. E. Coppedge* is named in honor of the youngest son of Mr. and Mrs. Coppedge, recently deceased.

A fine ship is an enduring creation; a fitting memorial to the son of a real seaman.

SOLVE YOUR CRANKING PROBLEMS WITH

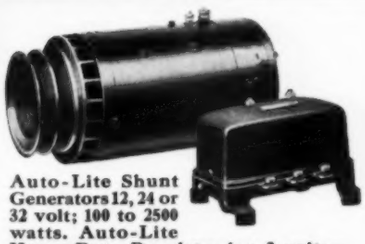
AUTO-LITE TWO STEP STARTER



AUTO-LITE'S revolutionary new starter for Diesels meshes on reduced voltage, cranks on full. This two-step operation is typical of the improved design which gives this better starting motor the excess margin of power so essential in Diesel operation. Quieter, more efficient, the two-step principle also greatly reduces possibility of damage to housing, pinion or ring gear.

Auto-Lite Starting and Generating systems for Diesels are designed and built by the World's largest independent manufacturer of automotive electrical equipment. For prices and complete details, write to

THE ELECTRIC AUTO-LITE COMPANY
TOLEDO, OHIO • SARNIA, ONTARIO



Auto-Lite Shunt Generators 12, 24 or 32 volt; 100 to 2500 watts. Auto-Lite Heavy-Duty Regulator has 3 units—voltage, current and cut-out relay—in one water and dust-proof assembly, maintains voltage to plus or minus 2%.

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LIGHTING • IGNITION
BATTERIES • WIRE & CABLE

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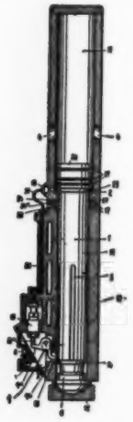
Latest Diesel Patents

A description of the outstanding patented inventions on Diesel and Diesel accessories as they are granted by the United States Patent Office. This information will be found a handy reference for inventors, engineers, designers and production men in establishing the dates of record, as well as describing the important Diesel inventions.

Conducted by C. CALVERT HINES*

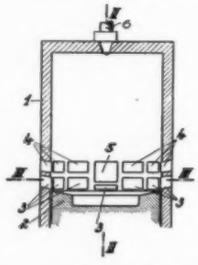
2,208,730
DIESEL MONKEY
Paul Pfeiffer, Altona, Germany
Application August 6, 1937, Serial No. 157,805
In Germany August 7, 1936
5 Claims. (Cl. 123—7)



1. In a Diesel monkey including fuel and air supplying means, a pair of alined vertical cylinders, one cylinder having a larger bore than the other, a ram having an enlarged head slidably mounted in the larger chamber and a reduced stem having a sliding fit in the smaller chamber; an expansible, annular combustion chamber in said larger cylinder adjacent its junction with said smaller cylinder, said air supply means comprising a suction operated intake valve in said smaller cylinder adjacent the lower end thereof, said stem being operative to suck air into said smaller chamber through said valve during a portion of the upstroke of said ram, longitudinally extending peripheral grooves on said stem of said ram for delivering air to said combustion chamber on the downstroke of said ram, said grooves terminating short of said enlarged head of said ram to trap a predetermined amount of said air in said combustion chamber during the latter part of the downstroke of said ram.

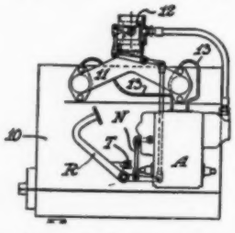
2,209,782
INTERNAL COMBUSTION ENGINE
Werner Lindner and Siegfried Grantz, Augsburg, Germany, assignors to Maschinenfabrik, Augsburg-Nurnberg A. G., Augsburg, Germany, a corporation of Germany
Application November 18, 1938, Serial No. 241,090
In Germany November 24, 1937
5 Claims. (Cl. 123—65)

1. In a two-stroke cycle engine, a cylinder and a piston operable therein, said cylinder having a row of exhaust ports and a row of scavenging air inlet ports arranged below the row of exhaust ports, said exhaust ports and inlet ports being adapted to be uncovered by the piston and arranged on only one side of the cylinder opposite an imperforate portion of the cylinder to provide for reverse scavenging flow from the



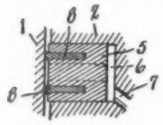
inlet ports across, along, and back along the cylinder to the exhaust ports, at least one of said exhaust ports being closely adjacent an inlet port and extended towards the inner dead center position of the piston to a greater extent than other exhaust ports and at least to the transverse plane defining the upper end of the row of inlet ports.

2,209,321
MEANS FOR FACILITATING THE STARTING OF INTERNAL COMBUSTION ENGINES FOR MOTOR VEHICLES USING A FUEL INJECTION PUMP
Richard Friedrich Colell, Edgbaston, Birmingham, England, assignor to The Austin Motor Company, Limited, Northfield, Birmingham, England
Application August 10, 1938, Serial No. 224,221
In Great Britain August 11, 1937
4 Claims. (Cl. 123—140)



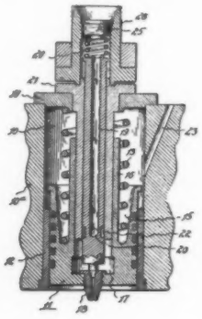
1. Means for controlling an internal combustion engine of the fuel injection type comprising a throttle lever to control a throttle valve, a vacuum chamber in connection with the engine suction manifold, a piston in said vacuum chamber, a fuel injection pump, a control rod controlling the quantity of fuel supplied at each stroke of the pump and connected to said piston in such a manner that as the vacuum decreases the control rod is moved in a direction to increase the fuel supply, a stop to limit the movement of said rod in said direction and said stop connected with said throttle lever, whereby said throttle lever, when moved towards its "off" or idling position, moves said stop in a manner to allow further movement of said control rod in a direction to permit of further increase of fuel supply to facilitate starting.

2,212,042
PISTON RING ASSEMBLY
Harold P. Phillips, Howard L. Heacock, and Harry Larsen, Hastings, Mich., assignors to Hastings Manufacturing Company, Hastings, Mich.
Application October 29, 1938, Serial No. 237,688
14 Claims. (Cl. 309—45)



1. A composite piston ring for an internal combustion engine, comprising an annular split carrier element of rectangular cross section adapted to be received within a piston groove for expansible action therein, said carrier element having a plurality of oil drainage openings therethrough and being provided with a pair of narrow annular peripheral grooves disposed one on either side of said openings, and a thin cylinder wall engaging element formed of ribbon steel in each of said grooves projecting radially beyond the face of the carrier element for cylinder wall engagement, said carrier element being out of contact with the cylinder wall, said cylinder wall engaging elements being subject to the expansive action of said carrier element.

2,230,920
INJECTION VALVE FOR INTERNAL COMBUSTION ENGINES
Ernst Wirtsen, Chester, Pa.
Original application August 31, 1936, Serial No. 98,775. Divided and this application October 14, 1938, Serial No. 235,070.
2 Claims. (Cl. 299—107.2)



1. An injection valve for internal combustion engines comprising a reciprocating piston working in a cylinder and actuated in one direction by compression within the engine cylinder, a spring actuating the piston in opposition to the compression, said piston having a recess extending into the same to near its outer end, and a nozzle in the outer end of the piston communicating with the recess and engine cylinder and having a valve seat at its inner end; together with a sleeve or stationary valve casing extending into the recess in the piston and terminating to form a fuel compression chamber intermediate the end of said valve casing and nozzle, a hollow fuel conducting piston rod extending through the valve casing and having a valve head at its outer end adapted to seat on said valve seat, the passage in the hollow piston rod communicating with ports discharging into the fuel compression chamber above the valve head and adapted to be closed by the lower end of the sleeve or valve casing, and a spring cooperating with the oil pressure to maintain the needle valve closed during the operation of the valve piston preliminary to the opening of the valve.

. . . . . *And now please turn to page 71*

* Patent Attorney, 811 E Street, N.W., Washington, D. C.

CAST FOR A LEADING ROLE IN INDUSTRY

Consider ArmaSteel

To Do the Job of Scarcer Metals

ArmaSteel castings offer important advantages for use instead of forged steel and other metals costly and difficult to obtain.

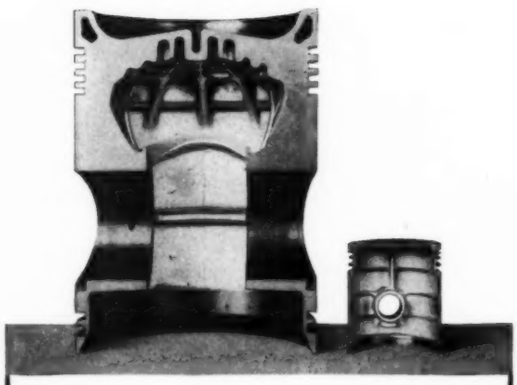
ArmaSteel gained wide acceptance in industry on its own merits long before the present emergency—not as an enforced substitute for steel, but as a superior metal. Therefore, engineers now facing a shortage of materials can judge the availability of ArmaSteel for their own purposes on the basis of its demonstrated performance records.

Compare the qualities and properties you require of a metal for use in your own product with the qualities and properties of ArmaSteel that led to its adoption by others, before there was any metal shortage, for such vital parts as these:

Diesel pistons for heavy-duty locomotives and trucks . . . Automobile pistons, piston rings, camshafts, Hydra-Matic transmission gears, drive-shaft universal yokes, clutch throwout collars, valve rocker arms . . . Refrigerator crankshafts and connecting rods . . . Washing machine drive gears.

ArmaSteel was adopted for these and other uses because of its high ratings in yield strength (comparable with forgings in the 1035-1050 range), hardenability (comparable with 5040-A steel), fatigue life, wear resistance, bearing properties, damping capacity, corrosion resistance, adaptability to selective hardening, and machinability. In many applications, ArmaSteel did more than meet the material specifications—it improved the product, reduced costs, and increased production.

To those interested in the possibilities of ArmaSteel for their own uses, we offer all our laboratory resources, our technical knowledge, and our 23 years' practical foundry experience.



PERFORMANCE PROOF

ArmaSteel more than made good in its first industrial use—one of its severest tests—when it was adopted for pistons of heavy Diesel locomotives. ArmaSteel stood up where other materials had failed, some ArmaSteel pistons now having lasted through more than 1,000,000 miles of service. Here are illustrated an 8½-inch Diesel piston and an automobile piston —both ArmaSteel.

What Is ArmaSteel?

ArmaSteel is a cast ferrous metal, produced, under strict technical control, in a wide range of physical properties adapting it to the exacting requirements of specific applications. It can be made in any specified yield strength up to 90,000 lb. per sq. in., and over a wide range of hardness, the most commonly used commercial ranges being 197-241 and 163-207 Brinell. As compared with steel bar stock and drop forgings of equal hardness, ArmaSteel possesses 10 to 30 per cent better machinability, resulting in a 20 to 100 per cent increase in finished parts per tool grind. Up to 50 per cent in man-hours of machining time is being saved where ArmaSteel castings have replaced forgings.

Saginaw Malleable Iron Division
General Motors Corporation, Saginaw, Michigan

CAST FOR A LEADING ROLE IN INDUSTRY

AIR COMPRESSORS

By R. L. GREGORY*

IN the last issue of DIESEL PROGRESS, the writer discussed the maintenance of centrifugal pumps. This article will be devoted to the discussion of air compressors. Whether your units are of the air injection type or solid injection, the great majority of plants have air compressor equipment, which plays an important part in the functions of the plant. This equipment should be kept in tip-top condition at all times.

In the air injection type of engine, the compressor, as almost universally adopted by all manufacturers, consists of three stages—low, intermediate, and high which, under normal operation with the suction throttle wide open, develops pressures as follows: low pressure, 40-55 lbs. per square inch; intermediate pressures from 200-250 lbs. per square inch; and high pressures from 1100 to 1300 lbs. per square inch. With such pressures, it can be readily recognized that this equipment must have the best of care and attention because of very definite reasons. Whenever air is compressed and subsequently cooled, even at low pressures, the process of compression develops heat, and the higher the pressure to which it is compressed, the higher the temperature generated. This, with the cooling off, tends to develop condensation which, in turn, has a direct action on the various parts of the compressor, especially the compressor valves.

Most compressor valves are of high-grade material and workmanship and, when properly lapped in to their respective valve seats, will give a comparatively long period of service. But the combination of the oil used, along with the moisture developed in compression, has a direct action on these valves and seats, and ofttimes we find slight pitting of the valve seats, and a carbon residue develops on the valves themselves due to the action of the heat generated upon the lubricant used. It is necessary, therefore, occasionally to remove these valves and thoroughly check them over. If this operation is neglected, the first thing you will find is a leakage in one stage or another, which throws back on to the other stages and causes them to work under abnormal conditions, thus affecting the efficiency of your compressor.

Since each stage is equipped with proper gauges, any valve giving trouble will be reflected by the gauges, and you can easily ascertain leaks from one stage to another by this method. Each stage of compression on an air injection engine is provided with cooling coils and these should be examined at definite periods, and the coils given a hydrostatic test of twice their working pressures.

Another item to be watched is the compressor rings. Many times you may have difficulty in maintaining blast pressure for full load and, upon examining the various stage valves you find them in good order, then check the compressor rings, for they may be excessively worn and should be replaced at once.

The most important factor regarding your compressor is that of lubrication. From the very nature and functions of the air compressors, we know that the conditions in the compressor cylinder vary from those as found in the power cylinders. Hence a different type of lubricant must be used. Here we have the absence of combustion, but we do have the moisture to contend with and, while provision is made to remove as much of this moisture as possible, it is never entirely eradicated.

Since the last stage of the compressor raises the pressure much higher, this will have the greatest heat and consequently the most moisture development in the cooling process. This wet high pressure air has a tendency to affect the lubrication by attacking the oil film between the cylinder walls and the compressor rings. This naturally results in excessive wear causing blowby and loss of efficiency. Then, too, if this oil film is destroyed, and the unit stands idle for a period of time, the moisture remaining will attack the parts of the valves and compressor walls where the oil film is lacking, causing rust and pitting. When the unit is again put in operation, the rust acts as an abrasive, which is very detrimental. Some engineer may ask "Well, if this is the situation, how am I to remedy that condition?" The answer is simple enough. In the first place, use the best grade of compressor oil obtainable. It may cost you more than some other oils, but if it maintains an oil film under such trying conditions and prevents rust by keeping the moisture away from the vital parts, it is money well spent and the cheapest in the long run.

In connection with this, there is another point to be taken into consideration. The writer once inspected a compressor which might be termed as literally soaked with oil. The engineer in charge got the idea that he could successfully use a medium-priced oil by using more of it. This idea was wrong from two standpoints. In the first place, the cheaper oil did not maintain a proper film, even though he did use more of it, and, secondly, so much of the oil was used that it carbonized to excess and he had no end of trouble in the high pressure stage. After cleaning up the equipment, putting in a high grade of compressor oil and cutting down the amount used, he eliminated this trouble.

Trouble may be encountered with even a high-grade oil unless discretion is used in its application. Since the cylinder walls are normally cooled by means of a water jacket, the oil film on the cylinder wall is of lower temperature than the air itself. Now, if an excess of good oil is used, some of it naturally must be carried over in a liquid state by the discharged air. What then becomes of this oil that is thus carried over? Considerable of it drops in the high pressure discharge valves, the hottest part of the compressor mechanism, with the result that excess carbon is formed on these valves. If this is allowed to remain for an extended period, it will not only foul the valves, but instances have been known where this excess deposit caused explosions.

Most all oil vendors can furnish you with a high-grade compressor oil. This oil does not have to be a heavy bodied oil, but it should have excellent lubricating qualities which will give a strong film of oil at all times under all conditions. It should not form a hard crystalline carbon deposit, and most high-grade com-

. . . . *And now please turn to page 61* . . . .

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* *Chief Engineer, Municipal Water and Light Plant, Hillsdale, Michigan.*

Supervising and Operating Engineers' Section

. . . . *Continued from page 58* . . . .

pressor oils contain an inhibitor which helps protect the compressor from rust and pitting. The same conditions which apply to the compressor on an air injection engine can be applied to your auxiliary compressor, or any other air compressor you may have in your plant. If given the proper attention and care, they will always be in serviceable condition.

The old saying that "A man is known by the company he keeps" might be paraphrased to read, "An Engineer is known by the condition in which he keeps his equipment". At any rate, he can be so judged. We of the Supervising and Operating Personnel are today placed "on the Spot," in the "all out" defense program. We cannot afford to sit calmly by and let the other fellow do the worrying. Let each and every one of us adopt a policy of going out, and all out, in keeping our equipment as near perfect as possible, thus adding our bit to victory.

★ ★ ★

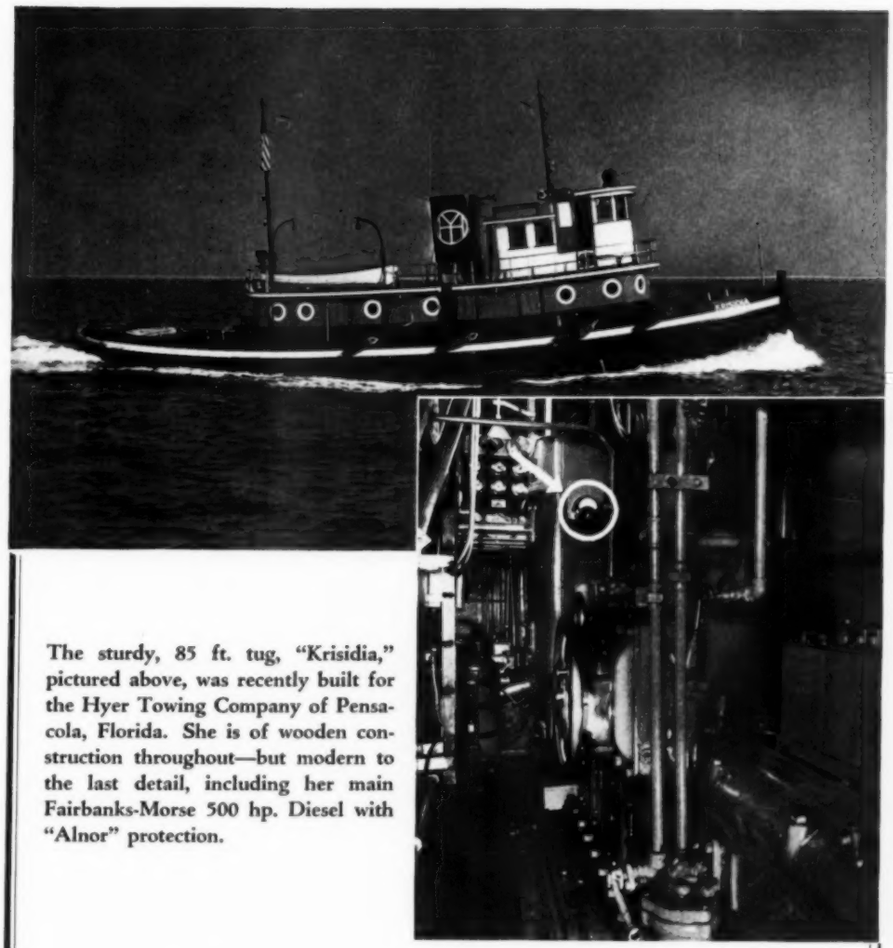
THE Diesel Convention will be held at Peoria, Illinois, Hotel Pere Marquette, June 17-19—make plans to attend now. Full details will appear in our May issue.

★ ★ ★

New Industrial Model Acousti-Booth Announced by Burgess

TO conserve steel for national defense, the Burgess Battery Company, Acoustic Division, 2815 West Roscoe St., Chicago, has developed a new line of Acousti-Booths, constructed of heavy reinforced birch plywood, specifically designed for industrial use. This new booth is available, without priorities, to all users, because no critical materials are used in its construction.

The walls and ceiling of this new booth consist of perforated, reinforced panels, which are



The sturdy, 85 ft. tug, "Krisidia," pictured above, was recently built for the Hyer Towing Company of Pensacola, Florida. She is of wooden construction throughout—but modern to the last detail, including her main Fairbanks-Morse 500 hp. Diesel with "Alnor" protection.

Alnor goes to sea

in all types of craft—tugs for commerce, the Army and the Navy, fishers from the East Coast, West Coast, and the Gulf, tankers, work boats, and cargo vessels plying the seven seas. Wherever costly Diesels are relied upon for both main and auxiliary ship's power, there you will find complete confidence in "ALNOR" for dependable indication of engine performance. Protect your Diesels with the best exhaust pyrometer—the instrument most generally used—"ALNOR."

●

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filled with a thick blanket of sound-absorbent material. The perforated acoustic panels blot out stray noise and create a remarkable "zone of quiet" in the booth. The combination of perforated heavy birch plywood and the sound-absorbent material, which it protects, is a patented Burgess development.

The industrial Model 207 Burgess Acousti-Booth is finished in an attractive gray, or can be supplied unfinished. A shelf is provided for the telephone instrument and for taking notes. Overhead electric light fixture with pull-chain provides ample illumination. Outside dimensions are 30 inches wide, by 79½ inches high, by 38 inches deep. Shipping weight, 225 lbs.

Gulf Announces A Revolutionary New Quenching Oil

GULF Oil Corporation announces the development of a revolutionary new quenching oil—Gulf Super-Quench. With a faster cooling rate, Super-Quench has dual-action: 1. It has a cooling rate intermediate between oil and water through the hardening temperature range. 2. It retains the slow speed of oil below the hardening temperature range.

This Super-Quench makes possible maximum physical properties, yet institutes no more distortion than do other quenching oils.

Developed through extensive research in Gulf laboratories, Super-Quench has been proven by service in the field—on many types of steels, and on various shapes. In many instances, quenching with this new medium has produced remarkable results.

FOR further information on Gulf Super-Quench, write to Gulf Oil Corporation, 3800 Gulf Building, Pittsburgh, Pa.

★ Here's how you can conserve our vital oil supply for planes, ships, tanks and trucks:

Install Luber-finer, *a genuine oil refiner,* on your motor. With refining packs replaced at proper intervals it saves unnecessary oil drains, costly repair bills and adds thousands of miles to oil and engine life.

Letters in our files indicate that Luber-finer users drive from 15,000 to 100,000 miles between crankcase drains. The oil thus saved is made available for our fighting forces.

Save Oil FOR DEFENSE, MONEY FOR YOU!

There's a Luber-finer for every type of engine and every type of oil.

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REFINES OIL EVERY MILE AS YOU DRIVE

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E. T. Fishwick

The grand old man of the Diesel Industry, E. T. Fishwick, died on March 15 at his home in Glen Ridge, New Jersey, and the Industry loses one of its most colorful personalities.

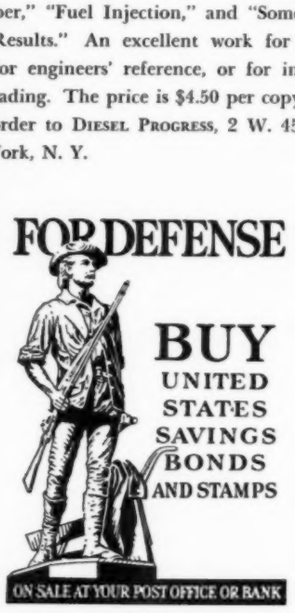
Ed Fishwick, as he was known by so many of us in the Industry, had been with the Worthington organization for 49 years, having started with the Corporation at its Cincinnati Works. When he died, Mr. Fishwick was senior vice-president of the Corporation. He was also president and director of the Worthington-Gamon Meter Company of Newark, New Jersey, a director of the New Jersey State Chamber of Commerce, and was formerly head of the Diesel Engine Manufacturers' Association. As a matter of fact, Ed Fishwick was one of the driving forces behind D.E.M.A. and, but for him, this Association might well have passed out on several different occasions in the past. He was a strong Diesel enthusiast and

was, in the main, responsible for his Corporation's going into the manufacture of Diesel engines away back in the early history of the Industry.

New Book By British Author On High-Speed Diesel Now Available

C. B. DICKSEE'S new work, "The High-Speed Compression-Ignition Engine," a textbook of 325 pages, completely illustrated, is now available in this country.

The purpose of the book is to deal with the basic principles governing the operation of Diesel engines with particular emphasis on the so-called "High-Speed" engine commonly associated with road transport work. It is in this field that the author has had wide experience from which he draws heavily in presenting the practical portions of his work. Chapter headings include, "The Laws of Gases," "The Idealized Cycles of Operation," "The Chemistry of Combustion," "The Losses and Limitations of the Practical Engine," "Types of Combustion Chamber," "Fuel Injection," and "Some Practical Results." An excellent work for school text, for engineers' reference, or for informative reading. The price is $4.50 per copy. Send your order to DIESEL PROGRESS, 2 W. 45th St., New York, N. Y.



Pedrick Enlarges Line of Engineered Piston Ring Sets

IN ITS new 1942 price-catalog, the Wilkening Manufacturing Co. of Philadelphia and Toronto lists a great many new Engineered Sets of Pedrick Piston Rings. Most important are the twenty-five new Engineered Sets primarily for use in farm tractors, and the new Sets for heavy-duty trucks and bus engines.

There are Engineered Sets for such important tractors as McCormick-Deering Farmall, John Deere, Caterpillar, Allis-Chalmers, Cletrac, Oliver, Fordson, Case and Rumely.

Among 140 Sets, primarily for truck and bus engines, are many for Autocar, Cummins Diesel, GMC, Hall-Scott, Hercules, IHC, Mack, Waukesha and White. One of the Sets engineered for Diesel engines is E273 for GMC 71 engine, containing special grooved and tinned compression rings and Pedrick Hydraulic oil rings similar to GMC original equipment.

The manufacturer claims that in each of these Engineered Sets has been accomplished the difficult job of combining in one piston ring installation all the features which are so necessary for *all-around* performance—oil control, blowby control, full power, gas economy, top-cylinder lubrication, minimum wear, long engine life.

A copy of the twelve-page price-catalog listing all 235 of Pedrick Engineered Sets will be sent to any interested party upon request.

Features...
DIESEL OPERATORS
WILL LIKE ABOUT
Eclipse aviation SEAMLESS
FLEXIBLE METAL HOSE
SEAMLESS
FLEXIBLE
DURABLE
MINIMUM WEIGHT
These features render Eclipse hose especially adapted for use in Diesel exhaust, water, and oil connections because:
• Seamless—means long lived; leak-proof.
• Flexible—means absorption of operating frequencies.
• Durable—means perfection of materials and manufacture.
• Minimum weight—means light weight construction obtained by the use of selected alloys specially heat treated.
Eclipse Seamless Flexible Metal Hose is supplied with single or multiple braided covering and armor casing, also in double wall types for air or water jacketed exhaust lines
Write for bulletin
ECLIPSE AVIATION
SEAMLESS FLEXIBLE METAL HOSE
MANUFACTURED AND SOLD BY
DEPT. 24 • PHILA. DIV. • BENDIX AVIATION CORPORATION

West Coast Diesel News

A. G. MULKEY, formerly branch manager at Seattle, Washington, has been appointed Pacific Coast manager by the Waukesha Motor Company of Waukesha, Wisconsin. He succeeds Herbert Wirshing with headquarters in Los Angeles, California.

CUMMINS marine Diesels are doing their bit in the Hawaiian Islands; a recent installation was made by von Hamm-Young Brothers Co. Ltd., Honolulu, of a HMR 602 in sampan cruiser for Elmer Galusha with the craft now doing duty in the Coast Guard Reserve patrol.

SHARK fishing on the coast has become so profitable that Dr. L. W. Hosford's yacht, *Panglima,* San Francisco, is being converted into a fisherman with a new D4600 Caterpillar Diesel as main power.

THE freighter *Skookum Chief,* Puget Sound Freight Lines, Seattle, Washington, is being repowered with two Washington 180 hp. Diesels replacing 100's of the same make. This will enable her to increase her weekly trips, Seattle to Shelton, from seven to ten.

PETER Johnson, Excursion Inlet, Alaska, repowered his 50-ft. seine boat *Johnny E* with a 3 to 1 reduction geared 100 hp. Gray Diesel in the Warner Machine Shop, Juneau, Alaska.

TWIN Buda Diesels with 2 to 1 reduction gears have been selected to power three 65-ft. passenger carrying vessels now under construction by the Shain Manufacturing Co., Seattle, Washington, with capacity of 150 persons.

CG *521,* new shallow-draft buoy-tender for the U. S. Coast Guard Service on the Upper Columbia River, is of all-welded construction, 65 feet overall, and powered with twin 165-hp. Gray Diesels with reduction gears giving a maximum speed of fifteen knots.

BACK in service after being completely rebuilt at the company's yard on Puget Sound, the Foss Launch and Tug Co., Seattle, Washington, towboat *Agnes Foss* with new twin Enterprise Diesels in her 150-ft. hull is one of the largest and most powerful vessels of her type on the West Coast.

THE new 64-ft. water taxi *Star,* built by the San Diego Marine Construction Co., San Diego, California, for the Star and Crescent Boat Co., same city, is powered with a 125 hp. 6 cylinder Cummins Diesel with Twin Disc gears giving a speed of 11.5 knots.

GRAY marine Diesels of 110 hp. and with 2 to 1 reduction gears have been installed in four 38 ft., forty passenger open launches built by the Shain Manufacturing Co., Seattle, Washington.

THE 128-ft. tuna clipper *Commander* building for John Vattuone and Sons by the Campbell Machine Co., San Diego, California, is powered with a 450 hp. Union Diesel. Two 200 hp. Diesels of same make drive 125 kw. generators.

FAIRBANKS-Morse equipped throughout, the 78-ft. tuna clipper *Sunset,* built by Hollinger-Millican, San Diego, California, for Bregante and Ghio, has a 240 hp. main engine and two 60 hp. auxiliaries, all Diesel, of course, and generators, motors and pumps are F-M make.

ATLAS Imperial Diesels have been selected to power four seiners under construction by the West Waterway Shipyards, Seattle, Washington; a 220 hp. in a 77-ft., a 80 hp. in a 56-ft., a 110 hp. in a 56-ft., and a 135 hp. in a 67-ft.

_____ it's worth REPEATING

Oil, in itself, is a precious commodity these days and must not be wasted. Equally essential to our war efforts are the engines it lubricates . . . they must be given every aid toward assuring uninterrupted and longer service. That's where VISCO-METER* plays a feature role in the defense picture.

Engineers agree that the most important single factor in engine performance and service life is constant and correct lubrication—and that everything in lubrication has to do with *viscosity.*

Unless the *viscosity* (lubricating ability) of the lubricant at crankcase temperatures is *visibly known continually* while the engine is in operation, you are taking chances . . . guessing.

VISCO-METER* offers the one dependable means of *making sure* of safe, efficient, adequate engine lubrication, because right before your eyes VISCO-METER* constantly *shows* the *viscosity* (lubricating ability) of the oil as it circulates in use.

In its construction and automatic operation the VISCO-METER* is simplicity itself. Measured in terms of improving operating efficiency, savings in parts and prolonging service life, the VISCO-METER* becomes a most important part of any engine . . . and will prove this in service on your engines.

If you design, manufacture or use internal combustion engines of any type, we invite your request for a VISCO-METER* engineer to call with the whole story. Write or wire:

VISCO-METER
CORPORATION GROTE ST., BUFFALO, N. Y.

**Fully covered by U. S. and Foreign Patents*

THE first of two 135 ft. minesweepers under construction by Al Larson Boatyard, Terminal Island, California, for the Navy has been launched. Power is a General Motors Diesel.

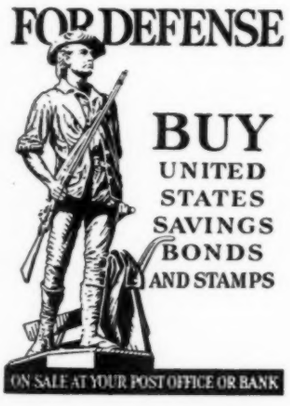
A 400 HP. Atlas Imperial Diesel will power the new 93-ft. seine boat under construction by the Tacoma Boat Building Company, Tacoma, Washington. The vessel is being built on speculation.

THE Peterson Boatbuilding Co., Tacoma, Washington, is building two 85-ft. seine boats powered with Atlas Imperial Diesels, 300 hp., and 250 hp., respectively for John Breskovich and John Peterson.

CATERPILLAR Diesel engine installations include a 60 hp. in the *Booth*, Columbia River Salmon Co.; 115 hp. in the dragger *Amak*, Charles Ellis; another 115 hp. in the crab boat, *Charles Haggland*, all of Astoria, Oregon.

ATLAS Imperial Diesels are being installed by the Pacific Boat Building Co., Tacoma, Washington, in the following vessels: 250 hp. in 80 footer for John Skansie; same in two 80's for the Oceanic Fisheries Co.

AT Astoria, Oregon, the Niemi brothers are installing a 100 hp. Lorimer Diesel in the new 56-ft. otter trawler. The vessel with a capacity of twenty-seven tons is expected to have a speed of nine knots. The brothers will fish the boat themselves.



Burgess Battery Company, Acoustic Division, Announces Change of Address

THE Acoustic Division of Burgess Battery Company announces a change of address to 2815 West Roscoe St., Chicago, effective March 30. Acoustic Division products include two lines: 1—Burgess Snubbers for preventing intake and exhaust noise from Diesel and other industrial engines, and 2—Burgess Acousti-Booths, for providing privacy and quiet when telephoning. Any correspondence relative to either of these products should be directed to the new address after March 30.

★ ★ ★

THE Maritime Commission has awarded a contract to the Gray's Iron Works, Inc., Galveston, Texas, for the construction of an additional coastal tanker, 1830 deadweight tons, with a capacity of 12,800 barrels. Dimensions are: length, overall, 220 ft., beam 37 ft., depth 14 ft. This tanker will be equipped with a Diesel engine developing a speed of 10½ knots.

New Booklet Describes Diesel Electric Locomotives

FOR large industrial plants, mines, and main line hauling, Diesel-electric locomotives of from 10 to 80 tons are described in a new 100-page booklet announced by Westinghouse Electric and Manufacturing Company.

Characteristics of Diesel-electric units are compared to steam and mechanical locomotives from the standpoint of availability, reliability, safety and pulling power. Performance opera-

KEEP 'EM RUNNING!

NOW, as never before, increased operating schedules must be maintained! No place in today's production for a Diesel out of operation because of damage that *could have been prevented easily.*

Penn Safety Controls offer efficient and dependable protection against two of the greatest threats to Diesel engine operation . . . lubricating oil failure and cooling water failure. These controls sound an alarm or *automatically stop* the engine *before damage can be done* if oil pressure drops dangerously low from any cause, or if the water cooling system fails.

In addition to this protection, an immediate operating economy is effected because Penn Safety Controls eliminate the need for constant supervision by operators. And yet, their cost is amazingly low!

Put Penn Safety Controls on your Diesels now and —*keep 'em running!* Get complete information . . . mail the coupon *today!*

MAIL COUPON NOW FOR DETAILS

PENN ENGINE CONTROLS

PENN ELECTRIC SWITCH CO., Goshen, Indiana.
Please send me your Bulletin E100 on Penn Safety Controls for Diesel engines.

Name_____

Address_____

City_____ State_____

tion, motor and control data are given for 76 typical installations.

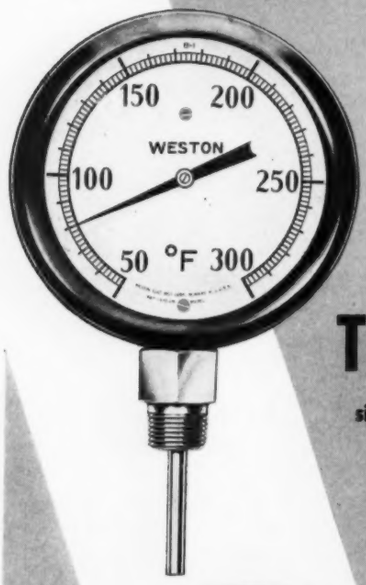
A discussion of main generators includes construction insulation, engine starting, and battery charging. Application and operation of controls cover the starting, running, and stopping sequence with an explanation of how smooth tractive effort is obtained. Determination of locomotive weight is quickly made from an application chart based on grades and load sizes. A tabulation of locomotive makes and models lists hp. tractive effort and speed.

A copy of booklet B-3000 may be secured from department 7-N-20, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pennsylvania.

★ ★ ★

A CUTTER of the tender class has been ordered from the Dubuque Boat & Boiler Works, Dubuque, Iowa, by the United States Coast Guard. This vessel will cost about $153,655 and will have dimensions of 100 ft. x 24 ft. x 4 ft. The power plant will consist of Diesel engines, developing 330 hp. on twin screws. Speed will be about ten miles per hour.

FOR CYLINDER TEMPERATURES...COOLING LINES...EXHAUST LINES



THE *All-Metal* THERMOMETER

simplifies installation . . . provides convenient readability . . . cuts maintenance 'way down

All-metal thermometers provide the advantage and convenience of direct temperature readings at each critical location. Easily mounted because no capillary or leads are required. Simplified all-metal construction resists breakage . . . safeguards the thermometer against damage or inaccuracies from over-ranging . . . and provides dependable service over longer periods. Guaranteed accurate within 1% over the entire scale. Available in types and sizes for diesel applications. Descriptive literature gladly sent on request. Weston Electrical Instrument Corporation, 579 Frelinghuysen Avenue, Newark, N. J.

WESTON *all Metal* TEMPERATURE GAUGES

Edwards Company Acquires Hill Diesel Plant; R. B. Rogers Is New President

SALE of one of the country's oldest and widely known Diesel engine manufacturing companies has been disclosed with the announcement of the purchase of the Hill Diesel Engine Company by the Edwards Company, manufacturers of self-propelled railway passenger motor cars. The Edwards plant is in Sanford, North Carolina, while all manufacturing activities of the Hill Company are centered in Lansing, Michigan. Both companies maintain executive offices at 724 Garrison Avenue, New York City.

Heading the new Hill management as president is Ralph B. Rogers, of New York City, who also is president of the Edwards Company. Mr. Rogers has been prominently identified with the Diesel engine industry for many years as a distributor and producer of Diesel power units. R. E. Olds, one of the outstanding figures in the development of the automobile industry, remains as chairman of the board of directors.

R. B. Rogers

For the present, at least, no changes in Hill manufacturing or merchandising policies are contemplated, according to Mr. Rogers. The company will continue to manufacture Diesel engines, power units and generating sets for industrial and marine service in the 15 to 51 hp. range.

Due to the demands for increased production created by war-time conditions, an extensive program of modernization and enlargement of manufacturing facilities has been started. Although this program was instituted only recent-

ly, production has been more than doubled in the last three months.

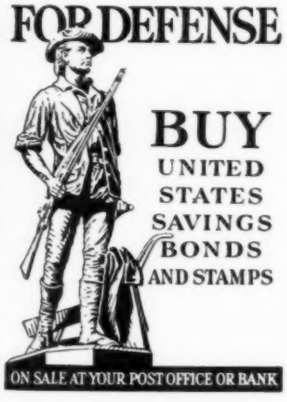
Hill has been manufacturing Diesels for more than twenty years and was identified with the early development of Diesel engines suitable for all types of small commercial enterprises. Profiting by this long manufacturing experience, thousands of Hill Diesel-owners in every phase of industry are today producing their own power at a cost far less than it could be purchased from most utilities or other sources.

The line of Hill Diesels includes the Models 2-R, 4-R and 6-R, with 3½" bore and 5½" stroke. All models are offered in various types of packaged power units and generating sets. Hill engines are of the vertical, four cycle, solid injection, full Diesel type. Although operating at medium speeds and having a comparatively low weight per horsepower, their design incorporates many desirable features of heavy, slow speed engines.

★ ★ ★

PLAN to attend the meeting of the Oil & Gas Power Division of the A.S.M.E. at Peoria, Illinois, June 17-19—Headquarters will be at the Pere Marquette Hotel.

★ ★ ★



W. E. Corrigan Heads Up Diesel Sales for American Locomotive Company

W. E. CORRIGAN, vice-president of American Locomotive Company in charge of munitions and miscellaneous sales, has assumed additional duties as head of Diesel engine sales, according to an announcement by Duncan W. Fraser, president. Diesel locomotive sales remain under the supervision of Perry T. Egbert.

Mr. Corrigan, who was a captain in the artillery ordnance branch of the U.S. Army during the last war, has participated in the negotiation of various recent government contracts with American Locomotive Company for the production of ordnance and other war materials. The company is making tanks, gun carriages, marine Diesel engines, shells, bombs, and heavy forgings. He started with the company in 1909, completed a four-year course in locomotive construction at its Schenectady plant, and since has served in various engineering sales capacities. He was elected vice-president in 1936.

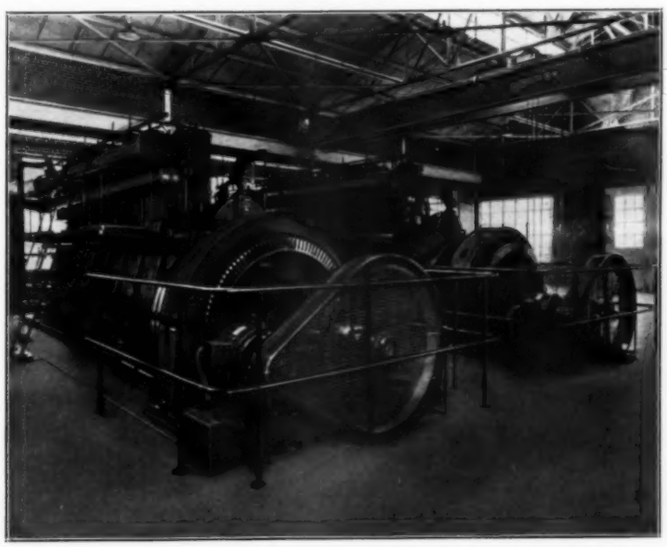
THE only bidder on February 17 at the Navy Department was The Buda Company when bids were opened for furnishing marine Diesel engines under schedule LL-900-7735. Price submitted was $20,790 on Lot 1.

★ ★ ★

Blackmer Bulletin Announces New Line of Pumps

BLACKMER Pump Company has recently published a four-page bulletin covering its new

Three 875 h.p. CHICAGO-PNEUMATIC Diesels at Important Defense Plant



• Shown at the left are two of the three Chicago Pneumatic heavy duty Diesels that provide electric power for a defense plant. All are equipped with Nugent Fuel Oil Filters.

. . . Protected by NUGENT FILTERS

AGAIN we find Nugent Pressure Filters doing "guard duty" for National Defense. This time their job is to keep fuel oil free from dirt for three 875 h.p. Chicago Pneumatic Diesel engines, which were installed recently in record time at an important defense project.

This is just one example of the numerous Nugent installations that are being made all over the country. Wherever fuel or lubricating oil is used, you can count on Nugent Filters to remove all dirt particles as small as .0003" from the oil, yet *without* removing any of the valuable chemical additives now commonly used to enhance lubrication qualities.

Write for complete information on Nugent Filters and Lubrication Specialties.

• At the right, above, is a Nugent patented pressure filter of the type installed on the three Chicago Pneumatic Diesels. These compact, easy-to-clean units have a filtering surface of 210 sq. in. At the left is a view of the filter cartridge used in these units.

Wm. W. Nugent & Co., Inc. Mfrs.
Oil Filters, Oiling and Filtering Systems, Telescopic Oilers, Oiling Devices
Sight Feed Valves, Flow Indicators, Compression Union Fittings, Oil Pumps, Etc.
415 N. HERMITAGE AVE. Established 1897 CHICAGO, U. S. A.

line of direct-connected rotary pumps with emphasis on a design feature which compensates for wear as the pump runs—a feature which results in long life and sustained volumetric efficiency. The bulletin is attractively printed in two colors with construction details and applications illustrated. Application selection data are tabulated. A copy will be supplied without charge upon request. Address Blackner Pump Company, Grand Rapids, Michigan, for Bulletin 110.

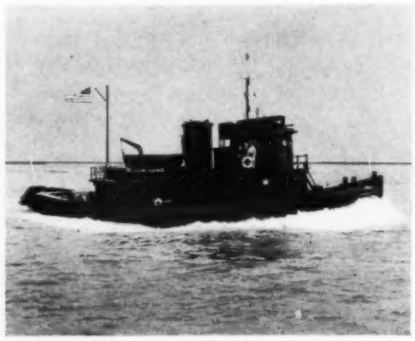
Fairbanks-Morse Earnings Up—1941 Sales Largest In History

IN ITS annual report to stockholders, Fairbanks, Morse & Co. report 1941 net sales of $48,520,958.67, largest in the company's history. The net profit for the year after taxes and a special reserve of $750,000.00 was $2,920,618.18 or $4.87 per share, largest since 1925. Net profit for 1940 was $4.59 per share. Taxes for 1941 amounted to $11.40 per share as compared with $5.59 in the previous year.

The company closed the year with a cash balance of $5,156,234.57, largest in company's history. A special reserve of $750,000 was set aside from profits to take care of inventory and conversion losses incident to war production.

There has been declared a regular dividend of 50 cents and a 50 cent extra payable March 31, 1942, to stockholders of record February 9, 1942.

First Lend-Lease Tug Delivered by General Motors



Here is shown the "BYT" "Confident," the first American-built vessel to be delivered to the British under the terms of the Lend-Lease Act.

DELIVERY to the British of the first two American-built vessels under the Lend-Lease program was announced by General Motors. Date and place of delivery, or where the vessels will be used, was not made public.

Both vessels are powerful Diesel-electric "BYT" (British Yard Tug) towboats, the first of a series of such craft now under construction. Named the *Busy* and the *Confident*, these Diesel tugs have an overall length of 102 feet 2 inches, a beam of 24 feet, and a draft of 10 feet 1 inch.

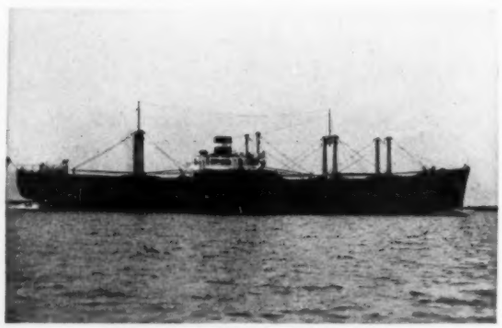
They were designed by General Motors, built by the Gulfport Boiler and Welding Works at Port Arthur, Texas, and are powered by 12 cylinder, 2 cycle General Motors Diesel engines, direct connected to 814 kw. electric generators and 24 kw. exciters, giving each vessel 1,000 shp. at 750 rpm.

General Motors, the announcement said, is now engaged in powering more than one hundred vessels of various designs for the British Government under the Lend-Lease arrangement.

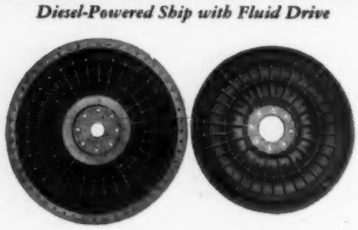
Goodrich Announces New Oil Resistant Hose

AN added construction for its Type 400SS oil hose, with elimination of all natural rubber and substitution of its own synthetic rubber, Ameripol, is announced by The B. F. Goodrich Company, Akron, Ohio.

Fluid Drives *for Industrial, Marine and Automotive Use*



Diesel-Powered Ship with Fluid Drive



A long history of successful operation is behind the present trend to Fluid Drive for marine Diesel applications. American Blower Fluid Drive is playing a vital role, too, in trucks, locomotives, bridges, oil drill rigs, power plants, excavators, conveyors, etc. Alert, resourceful American industry is, in fact, utilizing Fluid Drive in new and improved products, in ways never dreamed of but a few years ago. Have you investigated Fluid Drive?

AMERICAN BLOWER
HYDRAULIC COUPLING DIVISION
DETROIT, MICHIGAN
Division of American Radiator and "Standard" Sanitary Corporation

This type hose is also made with an Ameripol synthetic rubber tube, but with the cover and rubber used to impregnate the body plies of natural rubber. The new design incorporates Ameripol in every part of the hose.

All the hose is thus made resistant to the action of oils, gasolines or other solvents of natural rubber. This new construction also affords stronger adhesion of all parts with an additional margin of safety against ply separation.

Three Additional Atlas Imperial Diesel Installations by Conners Marine Co.

THREE installations are now in progress and nearing completion in tugboat hulls that will soon be placed in operation in New York Harbor and the New York State Barge Canal System by the Conners Marine Company, 21 West Street, New York, N. Y. These are the *Anna L. Conners*, a new 80′ all welded steel tug built by the Jakobson Shipyard at Oyster Bay, Long Island, to the design of Mr. Merritt Demarest, Naval Architect; the *Elise Ann Conners*, a 75′ charcoal iron steamboat hull formerly the *Harford*, acquired from the Warner Company of Philadelphia and now being repaired and converted to Diesel at the Jakobson Shipyard under the direction of Mr. Robert S. Haight, Naval Architect, and finally, the *Gramercy*, a 65′ wooden tug of their own fleet, whose original two cycle semi-Diesel engine is being replaced by the Marine Dry Dock & Repair Corporation, Foot of Washington Street, Jersey City, New Jersey.

The *Anna L. Conners* will have a six cylinder 15″ x 19″ Atlas Imperial Diesel rated to develop 600 hp. at 300 rpm.; the *Elise Ann Conners*, a six cylinder 13″ x 16″ Atlas Imperial unit rated 400 hp. at 300 rpm., and the *Gramercy*, a six cylinder 10½″ x 13″ Atlas Imperial unit rated 250 hp. at 350 rpm.

Other Atlas Imperial Diesel-engined tugs in the Conner fleet include the *Dynamic* with a 389 hp. unit, the *Harry R. Conners* with a 500 hp. unit and the *Tourist* with a 200 hp. unit.

Cummins Export Manager Adds Eastern Territory

THE Cummins Engine Company, Columbus, Indiana, manufacturers of Cummins Diesel engines for automotive, industrial, and marine service, has named Harry K. Smyth as Eastern Regional Manager. This new assignment for Mr. Smyth follows his appointment last August as Cummins Export Manager. As Export-Eastern Regional Manager, he will supervise

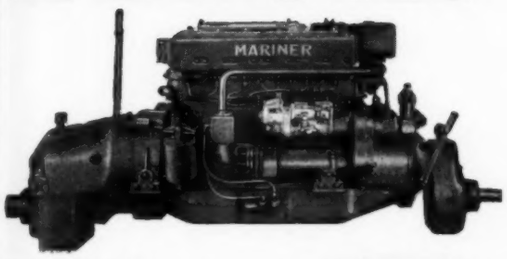
Harry K. Smyth

all Cummins sales activities in these two territories, with offices in the Chrysler Building, New York City.

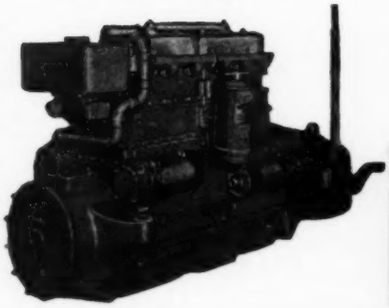
2 TOUGH DIESELS THAT ARE BETTER THAN THEIR BOAST!

Important to anyone who is thinking of getting the advantages of diesel power in his boat is this fact:—Mack Mariners, the finest diesels built, are *conservatively rated on a continuous duty basis.* When you buy a Mack Mariner you get full-power, sustained performance. *Plus the advantages of 4-cycle efficiency and Lanova controlled-combustion!* Mack Mariners give smooth-flowing, shockless power—they are specially built for heavy duty. Drop a postcard today for complete information.

MACK MANUFACTURING CORP., MARINE ENGINE DIVISION, LONG ISLAND CITY, N. Y.



MACK MARINER 605 W FOR WORK BOATS, 100 sustained h.p., at 1500 R.P.M. Bore 4⅝". Stroke 6"—6 cylinders, Lanova combustion.



MACK MARINER 457 W FOR WORK BOATS, 70 sustained h.p., at 1500 R.P.M. Bore 4¼". Stroke 5⅜"—6 cylinders, Lanova combustion.

Mack DIESEL MARINE POWER

MACK MARINE ENGINES ARE A PRODUCT OF THE BUILDERS OF WORLD-FAMED GASOLINE AND DIESEL-POWERED TRUCKS, BUSES AND FIRE APPARATUS

Mr. Smyth, a mechanical engineer, is well qualified for his present duties by virtue of a long and varied experience in the service of some of the world's outstanding machine tool and armament manufacturers. This experience covers executive assignments in engineering, production, sales, and administration in Australia, England, Japan, South America, as well as in the United States.

Fairbanks-Morse Announces Further Expansion of Diesel Engine Factory

A DOCUMENT officially announcing the intention of the United States Navy to spend $15,600,000 for buildings and equipment that will make it possible for the Beloit Works of Fairbanks, Morse & Co. in the next eighteen months to multiply by six its present output of Diesel engines and auxiliary equipment for the Navy has been received by the company. It was announced by Colonel Robert H. Morse, President of Fairbanks, Morse & Co., that the letter of intent authorized by Colonel Frank Knox, Secretary of the Navy, has been accepted by the company. Mr. Morse further announced that his company is proceeding at once to take all the steps necessary to meet the Navy Department's new demands.

The $15,600,000 allocation reported includes the original facility of approximately $6,000,000 announced several months ago. Shortly afterwards, the Navy required more of the production of Fairbanks, Morse & Co. and the appropriation was increased to $6,800,000. Then came the Jap attack on Pearl Harbor on December 7 and America's new status as an active belligerent brought still more Navy demands which has resulted in the latest boost in the total appropriation.

The new facility means the addition of more than 50,000 square feet of floor space to the 320,000 square feet already provided in the huge new building now under construction in Beloit. It means also the erection of several auxiliary buildings elsewhere on the plant, including one building of 30,000 square feet which will be used for the storage and warehousing of incoming parts and materials.

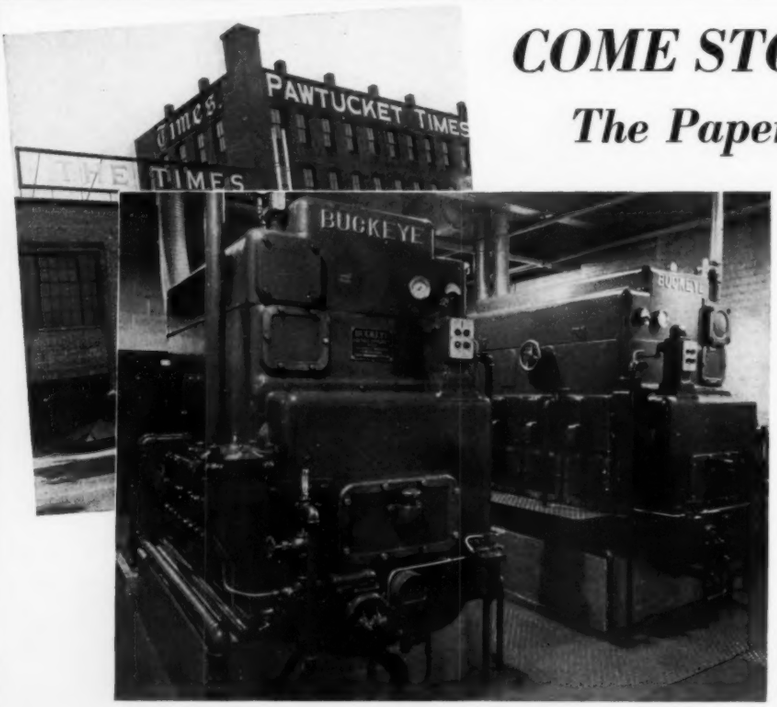
The Navy's demands for Fairbanks, Morse & Co. products can be graphically illustrated by a percentage comparison, using the company's output of navy material on January 1, 1941, as the base figure (or 100), then this production has been stepped up to 272 on January 1, 1942, and must be increased to 720 by next January and to 1536 (or more than fifteen times the January, 1941, output) by September, 1943.

It is expected that the number of employees now on the payroll of the Beloit, Wisconsin, plant will be increased by half when this new program of expansion is complete.

REA Moves to St. Louis

REA is moving to St. Louis, Missouri, in accordance with the President's orders for decentralizing Government activities. This move started on March 14 and will be completed about the first week of April. This will mean an unavoidable delay in answering correspondence and even in taking administrative action.

REA asks that you please address all mail for any REA division or for the REA Division of the Solicitor's office to Rural Electrification Administration, St. Louis, Missouri. Soon after April 1 REA will be settled in the Boatmen's Bank Building, at the corner of Locust Street and Broadway, and will welcome visitors there.



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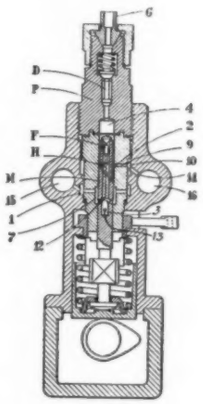
Diesel Patents

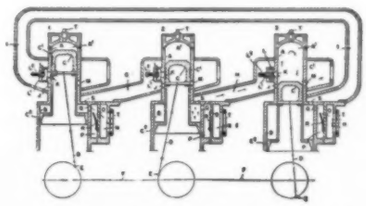
. . . *Continued from page 56* . . . .

2,230,622
FUEL PUMP FOR INTERNAL COMBUSTION ENGINES
Rudolf L'Orange, Stuttgart-Feuerbach, Germany
Application October 8, 1937, Serial No. 167,900
In Germany June 16, 1936
3 Claims. (Cl. 103—41



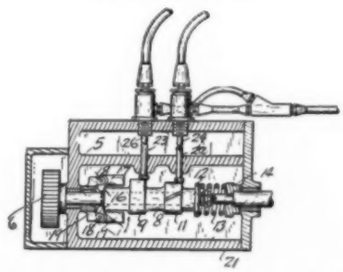
1. In a fuel injection pump for internal combustion engines, in combustion: a hollow plunger reciprocable in a casing having a pump chamber, a fuel inlet passage in communication with the hollow space in the plunger, a fuel return passage and a fuel delivery passage in said casing; and a spring loaded valve carried by the end of the plunger adapted when open to place the inlet passage in communication through the hollow space in the plunger with the delivery passage and with the return passage through said pump chamber, said plunger controlling the fuel return passage to maintain said passage in communication with the pump chamber during the initial portion of the working stroke of the plunger and to close said fuel return passage at low pressure to cut off communication between said fuel return passage and said pump chamber and to maintain said fuel return passage closed during the remainder of the working stroke of the plunger, the said valve closing after the closing of the fuel return passage, to cut off communication through the hollow space of the plunger between the fuel inlet passage and the pump chamber, completion of the working stroke of the plunger, after the closing of said fuel return passage and said valve, forcing the fuel from the pump chamber through the delivery passage.

2,230,308
INTERNAL COMBUSTION ENGINE
Ransom E. Olds, Lansing, Mich.
Application January 11, 1939, Serial No. 250,412
3 Claims. (Cl. 123—59)



1. In an internal combustion engine of the two-cycle fuel injection type, a series of stepped cylinders and cooperating pistons each having a small diameter power portion and a large diameter air compression portion, the latter displacing a measured volume of air, a conduit connecting the air compression portion of each cylinder with the power portion of another cylinder in endless series, each of said conduits communicating with the power cylinder through a piston controlled scavenging port located adjacent to the end of the power stroke of the piston and also through a separate valve controlled supercharging port located at an intermediate point in the stroke of the piston there being also an exhaust port in each power cylinder located intermediate said air inlet ports whereby a definite portion of the measured volume of air displaced in each air compression cylinder is utilized for supercharging the next cylinder in the series.

2,213,994
FUEL FEEDING DEVICE
John R. Rankin, Woodland, Calif.
Application March 1, 1939, Serial No. 259,246
3 Claims. (Cl. 74—568)



3. In a device of the character described, for use with an internal combustion engine having

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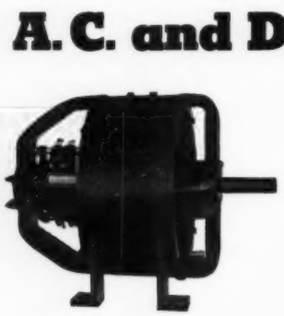

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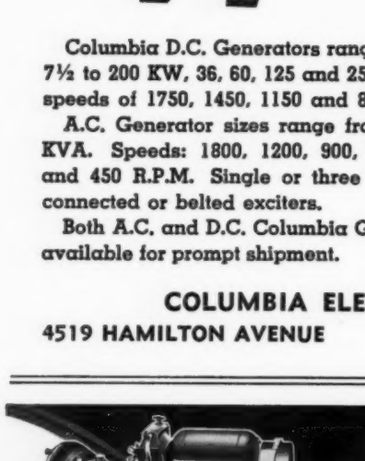

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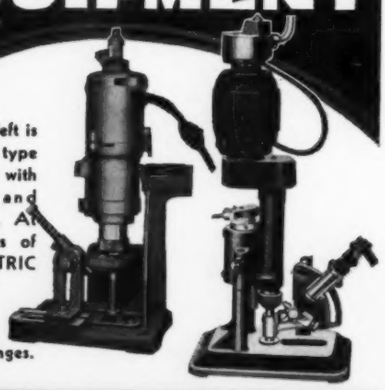

At upper left is HALL Wet type Valve Refacer with dual motors and rheostat control. At right, two types of HALL ECCENTRIC Diesel Valve Seat Grinders for covering most diesel ranges.

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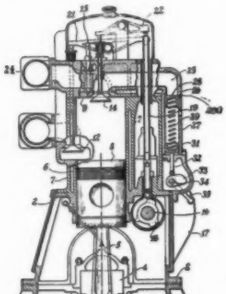
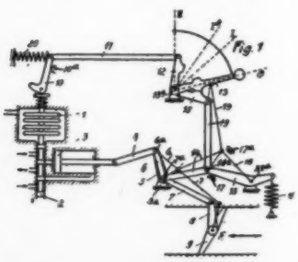
2,209,706
INTERNAL COMBUSTION ENGINE
Harold E. Rudd, Boonton, N. J.
Application June 10, 1937, Serial No. 147,448
6 Claims. (Cl. 123—64)



1. In an internal combustion engine, a cylinder, a piston therein, intake and exhaust passages thereto and control valve means cooperating therewith, and a variable volume auxiliary storage reservoir cooperating with said cylinder under the control of a valve means and means for opening said control valve for air acceptance periods and two air discharge periods, one discharge period for boosting the compression pressure and the other for discharging residual stored air to scavenge said cylinder.

2,213,412
POWER CONTROL GEAR FOR INTERNAL COMBUSTION ENGINES
Hans Rosskopf, Berlin-Charlottenburg, and Albert Stieglitz, Berlin-Spandau, Germany, assignors to Brandenburgische Motorenwerke Gesellschaft mit beschrankter Haftung, Berlin-Spandau, Germany, a corporation of Germany.
Application September 22, 1938, Serial No. 231,158
In Germany September 23, 1937
4 Claims. (Cl. 137—139)



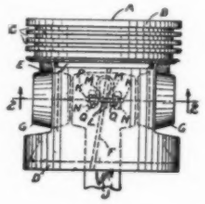
1. In an arrangement for regulating the power of supercharged internal combustion engines and including a supercharger throttle, a supercharger governor and a hand control element, both for controlling said throttle, a

throttle control gear interposed between said throttle and said hand control element to operate the throttle directly by hand within a given range from minimum power upward, and a throttle control gear between said governor and said first-named control gear and arranged to operate said throttle by the governor action exclusively when the first-named control gear has reached the extreme power end of its range, and means operable by said hand control element for varying the throttle control range of said governor after the latter has taken over the exclusive throttle control.

2,212,817

PISTON EXPANDER

Dallas M. Smith, Kirkwood, and George C. Mayfield, Richmond Heights, Mo., assignors to McQuay-Norris Manufacturing Company, St. Louis, Mo., a corporation of Delaware. Application January 6, 1940, Serial No. 312,752 3 Claims. (Cl. 309—12)



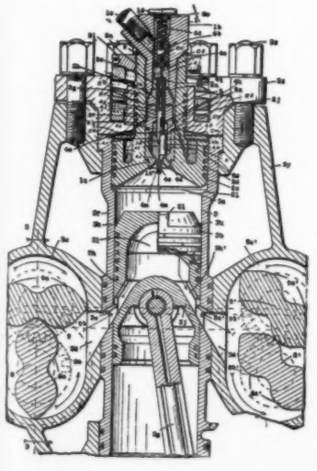
1. An expander for a piston skirt having an axially extending slot therein, said expander comprising a pair of parts anchored in the marginal portions of said skirt adjacent said slot, and a member including an overthrow cam engaging said parts and movable into a position to move said parts away from one another, whereby the marginal portions of said skirt will be separated to increase the circumference thereof.

2,206,027

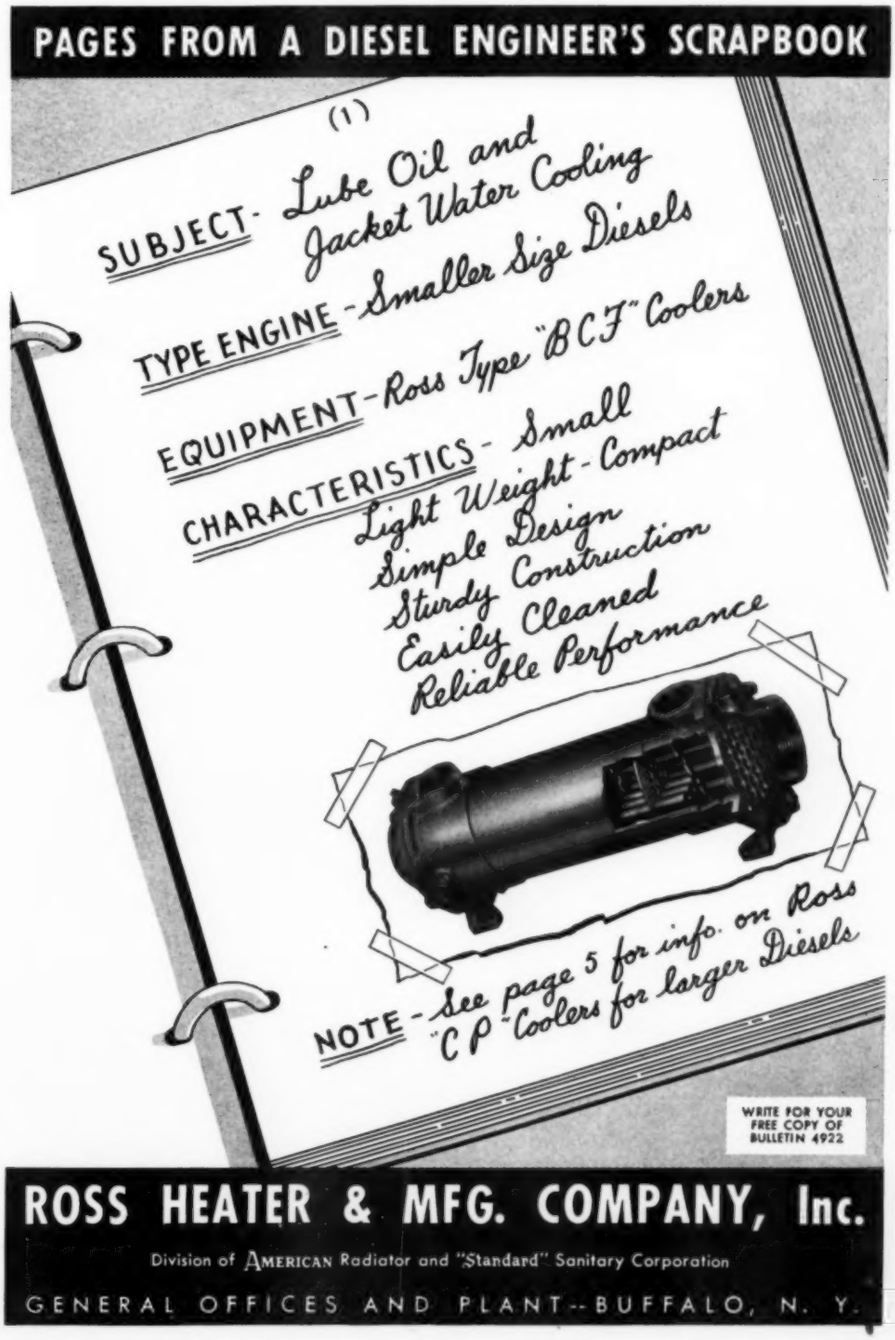
INTERNAL COMBUSTION ENGINE

Frank David Butler, United States Navy Application May 16, 1938, Serial No. 208,219 2 Claims. (Cl. 123—139)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)



1. In a liquid fueled internal combustion engine, means operated by compression pressures for atomizing and injecting a fuel charge into the combustion chamber of the engine in proper timing comprising a cylinder member in tandem relation with the combustion chamber, a hollow piston in said cylinder member, yieldable means urging said piston member toward the combustion chamber and permitting said piston member to retract under combustion chamber pressure, a fuel injection member extending through said hollow piston member in fixed relation to said piston member, a bore extending through said fuel injection member and having an enlarged counterbored chamber within said fuel injection member adjacent and connected to the combustion chamber end thereof, a fuel supply bore extending into said fuel injection member at the other end thereof, a smaller counterbore connecting said enlarged counterbored chamber to said fuel supply feeding bore, an actuating plunger slidably reciprocable within said connecting bore, an enlarged piston portion formed on said actuating plunger and reciprocable within said counterbored chamber, said counterbored chamber having a reduced end away from the combustion chamber end into which said enlarged piston portion may snugly enter and then trap combustion chamber gases therewithin, said actuating plunger being hollow and having a fuel discharge opening leading toward the combustion chamber, a valve seat within said enlarged piston portion, an opening extending through said enlarged piston portion from the entrapment chamber to said valve seat, a hollow valve member reciprocable within said hollow plunger, a valve face on said valve member adapted to seat against said valve seat, openings extending from said valve face to the hollow interior of said valve member, the hollow interior of said valve member connecting to said fuel supply bore and a rod extendable part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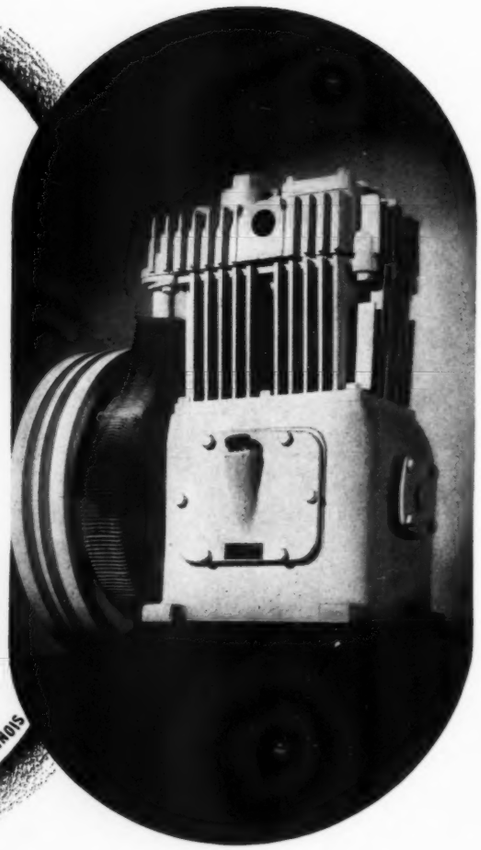

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way into the hollow interior of said valve member to entrap fuel in said valve as said valve member is reciprocated by the motion of said slidable piston, and thereby force fuel through said valve face against said valve face to commingle with and be atomized by the entrapped combustion gases forced therethrough by the reciprocation of said actuating plunger under compression pressure and force the atomized fuel through the discharge opening into the combustion chamber.

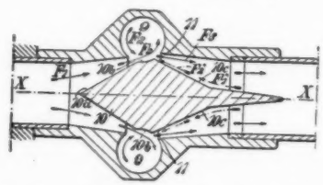
2,206,193

EXHAUST DEVICE FOR EXPLOSION OR INTERNAL COMBUSTION ENGINES

Michel Kadenacy, Paris, France

Original application August 1, 1934, Serial No. 738,016, now Patent No. 2,110,986, dated March 15, 1938. Divided and this application February 3, 1938, Serial No. 188,555. In Great Britain December 13, 1933

11 Claims. (Cl. 60—32)



1. Method of controlling two-stroke cycle internal combustion engines, which comprises establishing communication between the cylinder and exhaust system during the firing stroke, providing for the issuance of the burnt gases from the cylinder substantially as a mass in an interval of time shorter than that which would be required for the burnt gases to expand down to the ambient pressure by adiabatic flow, whereby the mass of gases moves outward and thereafter returns, permitting the free and unrestricted outward motion of the issuing mass of burnt gases, maintaining the admission orifice closed until the said issuance of the mass of burnt gases is in full progress, admitting fresh charge into the cylinder when the said issuance of the burnt gases is in full progress and causes a suction effect to be exerted in the cylinder, while the exhaust port is still open, and imparting a whirling motion to the issuing mass of burnt gases before it reaches the zone from which the return of the burnt gases would occur, whereby the return of the burnt gases to the cylinder is hindered.

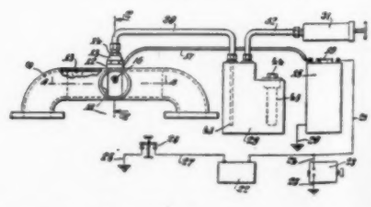
2,229,714

HEATER FOR STARTING DIESEL ENGINES

Gottfried Wirrer, Plainfield N. J., assignor to Mack Manufacturing Corporation, Long Island City, N. Y., a corporation of Delaware

Application April 19, 1939, Serial No. 268,681

6 Claims. (Cl. 123—179)



1. Starting device for internal combustion engines comprising, an air inlet manifold having an air inlet duct, a nozzle to supply fuel and air under pressure to the manifold in spray form adjacent said inlet duct, a baffle plate extending along said manifold and partially across said inlet duct and means to ignite said fuel in the manifold whereby combustion of said fuel heats the incoming air and said baffle plate.

2,212,167

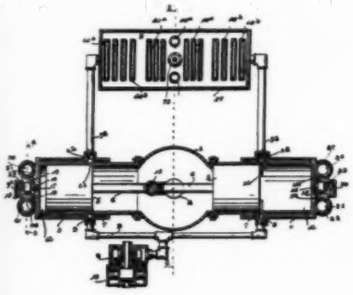
PRESSURE INJECTION AND DRIVING INTERNAL COMBUSTION ENGINE

Adolphe C. Peterson, Minneapolis, Minn. Application February 26, 1937, Serial No. 127,920

25 Claims. (Cl. 60—16)

1. A fuel vapor generator means embodying a liquid containing heating fluid container, a thermo-regulator means for the heating fluid container responsive to heat therein, a combustion supply means subject to control by the thermo-regulator means for heating the liquid in the heating fluid container, and a fuel container subject to the heat of the heating fluid in the heating fluid container and means for passing a liquid fuel into the fuel container, and fuel vapor therefrom and means for controlling the passage of fuel through the fuel container.

23. A means for supplying fuel to the cylinders of an internal combustion engine, embodying a means delivering liquid fuel under pressure to a fuel vapor generator, a supplementary means for heating the fuel vapor generator to vaporize liquid fuel under pressure therein, a thermo-regulator means subjected to the heat of the vaporized fuel of the said generator, and



controlling the heating thereof by said supplementary means, and means for cyclically distributing and injecting vaporized fuel under pressure from the fuel vapor generator to the cylinders of the engine and means for supplying charges of air to the cylinders for compression therein for combustion of the fuel.

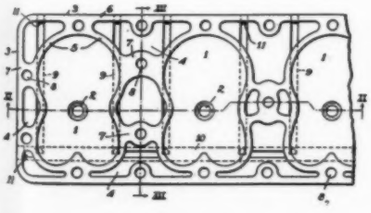
2,230,225

CYLINDER HEAD

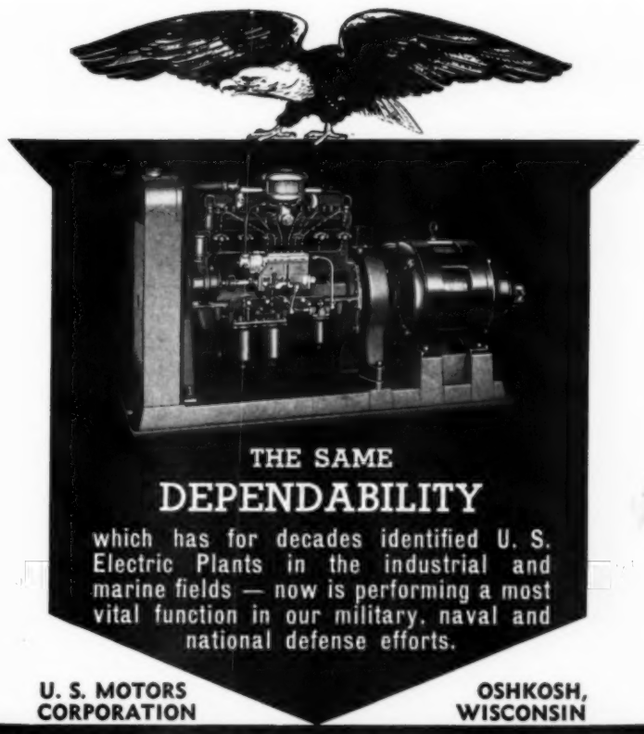
Russell G. Anderson, Bedford, Ohio, assignor to Aluminum Company of America, Pittsburgh, Pa., a corporation of Pennsylvania

Application May 24, 1939, Serial No. 275,416

7 Claims. (Cl. 123—173)



1. A one-piece, liquid-cooled cylinder head for an internal combustion engine comprising a plurality of combustion chambers, a plurality of liquid chambers adjacent the walls of said combustion chambers and directly connecting with liquid passages contained in the cylinder block of said internal combustion engine, a plurality of transverse, drilled liquid passages intersecting with at least some of said liquid chambers and being adjacent to the combustion chamber top, said drilled passages connecting with one or more longitudinal, drilled liquid passages, thereby facilitating complete coolant circulation throughout the cylinder head.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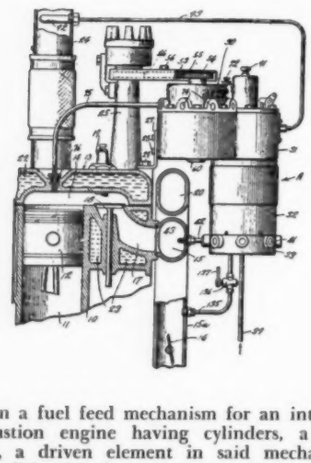
2,213,683

FUEL FEEDING MECHANISM

Thomas A. Banning, Jr., Chicago, Ill., assignor, by mesne assignments, to Borg-Warner Corporation, Chicago, Ill., a corporation of Illinois.

Application July 17, 1936, Serial No. 91,089

27 Claims. (Cl. 123—140)



1. In a fuel feed mechanism for an internal combustion engine having cylinders, a fuel pump, a driven element in said mechanism connectible with the engine to be driven thereby and drivingly connected to said pump, a pressure responsive device in said mechanism, means associated with said driven element for establishing communication successively between the compression chambers in the cylinders of the engine and the pressure responsive device, control means operatively connected to said fuel pump and said pressure responsive device for controlling said pump in accordance with compression pressure in said cylinders, and means for varying said compression pressure including air supply means for the cylinders of the engine having a valve member therein for controlling the passage of air to the cylinders.

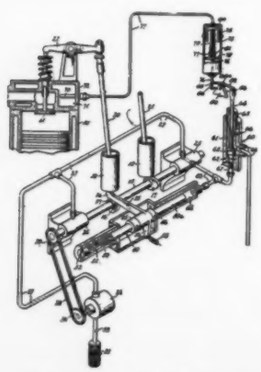
2,209,496

AUTOMATIC COMPRESSION CONTROL FOR ENGINES

Richard D. Watson, Los Angeles, Calif., assignor of one-half to George Yates, Glendale, Calif.

Application February 15, 1939, Serial No. 256,497

21 Claims. (Cl. 123—182)



1. A system for controlling the compression of engines having valve actuating mechanism including means adapted to be interposed in said valve actuating mechanism for preventing closing of a valve actuated thereby, means tending to interpose said first means, and means controllable by the engine operation for maintaining said first means in non-interposed position.

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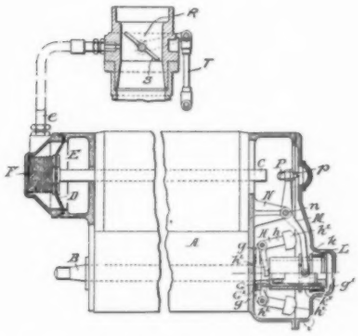
2,229,048

MEANS FOR FACILITATING THE STARTING OF INTERNAL COMBUSTION ENGINES FOR MOTOR VEHICLES USING A VACUUM-GOVERNED FUEL INJECTION PUMP

Richard Friedrich Colell, Edgbaston, Birmingham, England, assignor to The Austin Motor Company, Limited, Northfield, Birmingham, England

Application September 7, 1938, Serial No. 228,870
In Great Britain September 8, 1937
3 Claims. (Cl. 123—140)



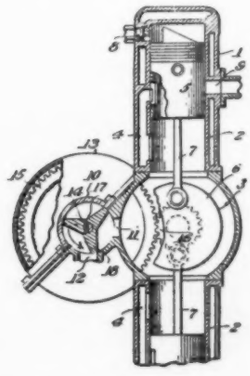
1. In an internal combustion engine of the fuel injection type, means for controlling the fuel supply comprising a throttle valve, a throttle lever to control the throttle valve, a hollow casing forming a vacuum suction chamber, a passage connecting said chamber to the engine section, a spring-pressed diaphragm in said vacuum chamber functioning as the main fuel governor operative at all engine speeds to control the fuel supply, a fuel injection pump, a control rod controlling the quantity of fuel supplied at each stroke of the pump and connected to said diaphragm in such a manner that as the vacuum decreases the control rod is moved in a direction to increase the fuel supply, a stop to limit the movement of said rod in said direction, said stop remaining in one definite position during all normal running speeds, and an auxiliary centrifugal governor by means of which said stop is moved out of said definite position to allow of the injection of an excess of fuel for starting and moved back to its definite position for running.

2,215,030

MULTIVANE INTAKE CONTROL VALVE

Clifton M. Chastain and Shirley Johnson, Mineral Wells, Tex.

Application April 18, 1938, Serial No. 202,777
2 Claims. (Cl. 123—56)



1. The combination with an internal combustion engine of the type having a crankcase directly communicative with cylinders posi-

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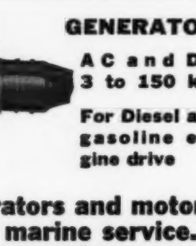

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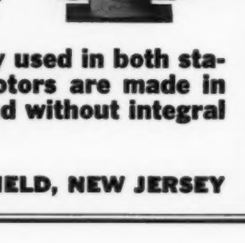

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tioned at diametrically opposed sides thereof, said cylinders having hollow pistons reciprocally mounted therein, said pistons having piston rods pivotally connected thereto and to a crankshaft disposed within said crankcase, said cylinders having fuel passages exteriorly thereof opening through the cylinder walls at spaced points therealong in a manner whereby the upper ends will open into the cylinders above the said pistons and the lower ends of the said passages will open into the cylinders through an aligning port in the piston walls when the said pistons have completed their power stroke, the ports in the said pistons being adapted to move out of engagement with the openings of the fuel passage during their compression stroke; of a cylindrical housing formed exteriorly of the crankcase, said housing being entirely enclosed except for an outlet port communicating with the crankcase and an inlet port disposed at right angles to the said outlet port and communicating with a source of fuel supply; a valve member axially mounted for rotation within said housing, said valve having three equi-spaced radial vanes having a wiping contact with the inner wall of the housing; and means to rotate said valve member in a manner whereby adjacent vanes will permit direct communication between the inlet and outlet ports at preselected intervals and close communication therebetween at other preselected intervals.

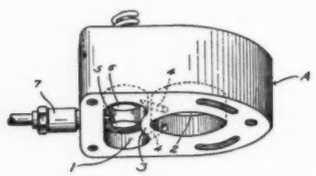
2,206,322

DIESEL ENGINE COMBUSTION CHAMBER

Elmer E. Huesby, Los Angeles, Calif.

Application September 8, 1938, Serial No. 228,907

3 Claims. (Cl. 123—32)



1. In a Diesel engine, a cylinder, a cylinder head, said head having an elongated combustion chamber therein in part registering with the bore of the cylinder and provided with rounded ends, said head having an air compression chamber adjacent said combustion chamber and in full registration with the bore of said cylinder, and an arcuate partition separating said chambers in said head and having passages communicating at certain ends with said compression chamber, said passages opening tangentially of and into the rounded ends of said combustion chamber for creating dual turbulence of air injected into said chamber.

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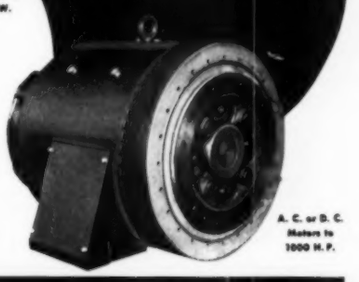

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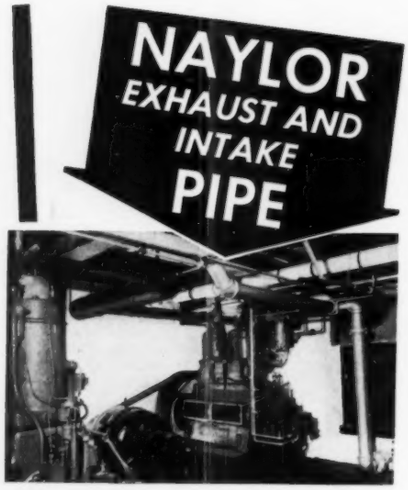

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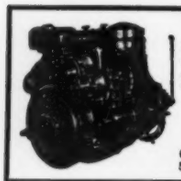

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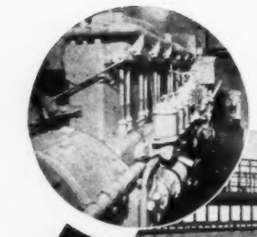

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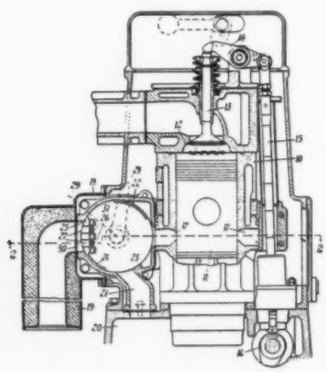
Mineola, L. I. — 140th Street and East River, New York City — Poughkeepsie, N. Y.

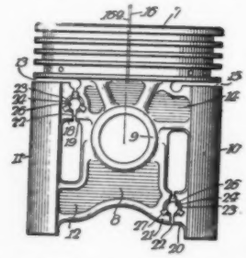
Owners—Spearin, Preston & Burrows, New York.

2,206,632
TWO-STROKE CYCLE INTERNAL COMBUSTION ENGINE
Albert Henry Cornish and Michel Kadenacy, Slough, England; said Cornish assignor to Armstrong Whitworth Securities Company Limited, Slough, England
Application February 14, 1939, Serial No. 256,383
In Great Britain February 16, 1938
14 Claims. (Cl. 123—65)



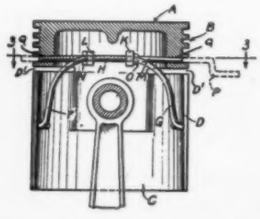
1. In a two-stroke cycle internal combustion engine of the kind wherein at least a substantial portion of the burnt gases leaves the cylinder at a speed much higher than that obtaining when a flow resulting from an adiabatic expansion only is involved, and in such a short interval of time that it is discharged as a mass leaving a depression behind it which is utilised in introducing a fresh charge into the cylinder, by opening the inlet orifice with the required delay after the opening of the exhaust orifice to ensure that the burnt gases are then moving outwardly through the exhaust orifice or duct and that a suction effect is exerted at the inlet orifice as a consequence of the exit of the said mass, a conduit leading from the atmosphere and connected to the inlet orifice, a compressor connected to said conduit, a two position oscillatory valve in said conduit adapted in one position to connect the compressor to the inlet orifice of the cylinder, and in a second position to cut off the connection between the compressor and the inlet orifice and to connect the inlet orifice freely to the atmosphere, and a non-return valve in said oscillatory valve so arranged as to provide one-way communication between the atmosphere and said inlet orifice and so located that it does not affect the flow of air from the compressor to the cylinder.

2,210,310
PISTON FOR INTERNAL COMBUSTION ENGINES AND THE LIKE
Macy O. Teetor, Newcastle, Ind., assignor to Perfect Circle Company, Hagerstown, Ind., a corporation of Indiana
Application April 22, 1939, Serial No. 269,376
14 Claims. (Cl. 309—11)



1. In a piston, a head, hanger means depending from and within said head, rigid bearing shoes on opposite sides of said piston, one of said shoes being connected on its inner side and interiorly of its bearing face and at its lower end to said hanger means with its upper end separated from said head by a slot, and the other shoe being connected on its inner side and interiorly of its bearing face and at its upper end to said hanger means with its lower end separated from the hangers.

2,212,902
PISTON EXPANDER
Dallas M. Smith, Kirkwood, Mo., assignor to McQuay-Norris Manufacturing Company, St. Louis, Mo., a corporation of Delaware.
Application January 6, 1940, Serial No. 312,747
5 Claims. (Cl. 309—12)



1. A piston skirt expander comprising a pair of legs movable relative to one another and means for moving said legs and maintaining said legs in predetermined adjusted position whereby the expansive force exerted by said expander in a piston may be varied.